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THOMAS PARRAN, *Surgeon General*

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CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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Public Health Reports

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DISABLING MORBIDITY AMONG INDUSTRIAL WORKERS, THIRD QUARTER AND THE FIRST 9 MONTHS OF 1939[1]

By WILLIAM M. GAFAFER, *Senior Statistician, United States Public Health Service*

The data on the frequency of sickness and nonindustrial injuries lasting 8 consecutive calendar days or longer during the third quarter and the first 9 months of 1938 and 1939, presented in table 1, are derived from analyses of reports from 26 sick benefit organizations, each representing approximately 170,000 members in industrial establishments located east of the Mississippi River and north of the Ohio and Potomac Rivers. While the rates for the third quarter and the first 9 months of 1938 and 1939, respectively, are determined for the same 26 organizations, the rates for the first 9 months of the quinquennium, 1934–38, are based on some additional reporting organizations.

THIRD QUARTER OF 1939

A comparison of the rates for the third quarter of 1939 and 1938 reveals only minor differences in the broad cause groups of respiratory diseases, digestive diseases, and nonrespiratory-nondigestive diseases. Of interest, however, are decreases of 20 percent for diseases of the pharynx and tonsils, and for diseases of the stomach, except cancer, the rates for 1939 and 1938, respectively, for both these groups of diseases being the same. Of interest also is an increase of almost 25 percent in the frequency of appendicitis.

DISEASES OF THE SKIN, 1930–39

Attention is also directed to diseases of the skin[2] which show a slight decrease for the third quarter of 1939 as compared with the corresponding quarter of 1938. The recognition of this more or less favorable rate raises the question of its magnitude in relation to previous years. Data, by quarters, for the years 1930 to 1939, obtained from earlier reports of this series and from table 1, are given

[1] From the Division of Industrial Hygiene, National Institute of Health.
For the second quarter of 1939, see PUBLIC HEALTH REPORTS for October 20, 1939 (54: 1878–1880).

[2] International List, 151–153. These titles do not include sunburn, poisoning by caustic substances, or the myceoses.

TABLE 1.—*Frequency of cases of sickness and nonindustrial injuries lasting 8 consecutive calendar days or longer among* MALE *employees in various industries, by cause, the third quarter of 1939 compared with the third quarter of 1938, and the first 9 months of 1939 compared with the first 9 months of 1938 and 1934–38, inclusive* [1]

[Male morbidity experience of industrial companies which reported their cases to the United States Public Health Service]

Cause (numbers in parentheses are disease title numbers from the International List of the Causes of Death, 1929)	Annual number of cases per 1,000 males				
	Third quarter		First 9 months		
	1939	1938	1939	1938	1934–38
Sickness and nonindustrial injuries [2]	68.4	71.1	92.2	82.5	89.5
Nonindustrial injuries (163–198)	11.1	12.1	10.2	11.1	11.5
Sickness [2]	57.3	59.0	82.0	71.4	78.0
Respiratory diseases	14.1	16.8	36.3	26.1	31.8
Influenza and grippe (11)	3.9	4.4	18.7	9.5	14.6
Bronchitis, acute and chronic (106)	2.2	2.6	4.0	4.0	4.1
Diseases of the pharynx and tonsils (115a)	3.2	4.0	4.7	4.8	5.0
Pneumonia, all forms (107–109)	1.1	1.3	3.0	2.1	2.4
Tuberculosis of the respiratory system (23)	.5	.9	.7	1.0	.9
Other respiratory diseases (104, 105, 110–114)	3.2	3.6	5.2	4.7	4.8
[illegible]ratory diseases	41.1	39.7	43.5	43.2	43.7
[illegible]	14.0	13.2	13.9	13.5	13.7
Diseases of [illegible], except cancer (117, 118)	3.2	4.0	3.5	4.1	3.8
Diarrhea and enteritis [illegible]	1.5	1.3	1.2	.9	1.3
Appendicitis (121)	4.8	3.9	4.5	4.2	4.3
Hernia (122a)	1.5	1.5	1.6	1.7	1.6
Other digestive diseases (115b, 116, 122b–129)	[illegible]	2.5	3.1	2.6	2.7
Nondigestive diseases	27.1	[illegible]	29.6	29.7	30.0
Diseases of the heart and arteries, and nephritis (90–99, 102, 130–132)	3.5	3.6	4.3	4.1	3.9
Other genitourinary diseases (133–138)	2.5	2.3	2.3	2.4	2.4
Neuralgia, neuritis, sciatica (87a)	2.1	1.8	2.2	2.1	2.2
Neurasthenia and the like (part of 87b)	.8	.8	.9	.9	1.0
Other diseases of the nervous system (78–85, part of 87b)	1.1	1.2	1.1	1.2	1.2
Rheumatism, acute and chronic (56, 57)	2.5	3.1	3.6	3.8	4.2
Diseases of the organs of locomotion, except diseases of the joints (156b)	2.8	2.4	2.6	2.7	2.9
Diseases of the skin (151–153)	3.4	3.7	2.8	3.1	2.9
Infectious and parasitic diseases (1–10, 12–22, 24–33, 36–44)	1.8	1.5	2.4	2.3	2.7
All other diseases (45–55, 58–77, 88, 89, 100, 101, 103, 154–156a, 157, 162)	7.1	6.1	7.4	7.1	6.6
Ill-defined and unknown causes (200)	2.1	2.5	2.2	2.1	2.5
Average number of males covered in the record	175,584	165,073	172,156	167,922	160,215
Number of organizations	26	26	26	26	-------

[1] In 1939 and 1938 the same organizations are included; the rates for the first 9 months of the years 1934–38, however, are based on records from the same 26 organizations and some additional reporting organizations.
[2] Exclusive of disability from the venereal diseases and a few numerically unimportant causes of disability.

TABLE 2.—*Frequency of disabling cases of skin diseases* [1] *lasting 8 consecutive calendar days or longer among* MALE *employees in various industries, by quarter years, 1930 to 1939, inclusive*

Year	Annual number of cases per 1,000 males			
	First quarter	Second quarter	Third quarter	Fourth quarter
1930	3.6	3.9	4.4	3.7
1931	2.7	3.3	3.8	3.1
1932	2.3	2.8	3.4	2.6
1933	2.5	1.9	3.5	2.7
1934	2.3	2.2	3.3	2.4
1935	2.4	2.2	3.5	2.7
1936	2.4	2.4	3.8	3.3
1937	3.1	2.9	3.4	3.1
1938	3.0	2.7	3.7	2.5
1939	2.7	2.2	3.4	------------
Mean, 1930–39	2.7	2.7	3.6	2.[illegible]

[1] Includes furuncle, carbuncle; phlegmon, acute abscess; and other diseases of the skin and annexa, and of the cellular tissue (titles 151–153 of the International List of Causes of Death, 1929).

in table 2 and are shown graphically in figure 1. The frequency of diseases of the skin over this 10-year period is of considerable interest. Perhaps most outstanding is the fact that for each of these years the rate for the third quarter is the highest of all quarter rates. This is particularly striking when it is considered that a time curve representing total disabilities is generally lowest in the third quarter, and that the definition of "diseases of the skin" does not include sunburn, poisoning by organic substances, or the mycoses. It will be observed, furthermore, that while the mean (3.6) of the 10 third-quarter rates is the highest of the four means representing the four sets of quarters, the stability of the third-quarter rates is greatest, varying, as they do, in the relatively narrow zone of 3.3 (1934) to 4.4 (1930).

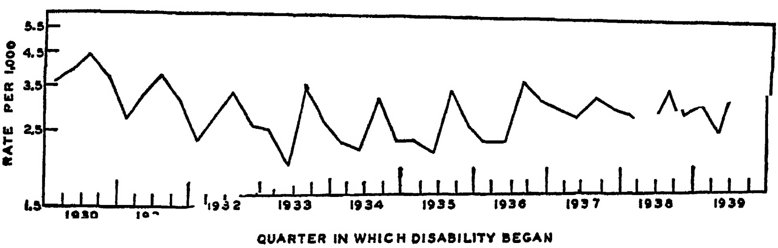

FIGURE 1.—Frequency (logarithmic) of disability lasting 8 consecutive calendar days or longer caused by diseases of the skin, by quarter-year of onset, 1930-30, inclusive. Diseases of the skin (titles 151-153 of the International List of Causes of Death, 1929) includes furuncle, carbuncle; phlegmon, acute abscess; and other diseases of the skin and annexa, and of the cellular tissue. This definition does not include sunburn, poisoning by organic substances, or the mycoses. (Male morbidity experience of industrial companies which reported their cases to the United States Public Health Service.)

FIRST 9 MONTHS OF 1939

An inspection of the frequencies of sickness and nonindustrial injuries for the first 9 months of 1939 and 1938 in the light of the experience recorded for the third quarters of the same years reveals that the unfavorable sickness rate for 1939 is due principally to the excessive rate for influenza and grippe previously referred to in the summaries for the first and second quarters of the year.

MORTALITY RATES AND ECONOMIC STATUS IN RURAL AREAS[1]

By HAROLD F. DORN, *Statistician, United States Public Health Service*

It has been believed for some time that health and economic status are directly related. Such data as exist indicate that both morbidity

[1] The tabulation of these data was made possible by the support and cooperation of the Scripps Foundation for the Study of Population Problems. Mr. I. C. Plummer, Chief, Division of Vital Statistics of the State Department of Health of Ohio, not only gave access to the original records, but also made available the facilities of his office during the tabulation of the data. This material was taken from a thesis submitted to the faculty of the Graduate School of the University of Wisconsin in partial fulfillment of the requirements for a Degree of Doctor of Philosophy.

and mortality rates are generally higher among the poor than among the well-to-do, although some deviation from this occurs when specific causes of illness or death are considered. With very few exceptions, however, the available information refers solely to village or city residents. Almost no data concerning the relationship of health and economic status of rural residents in the United States are available.

During the course of a study of differential rural-urban mortality in Ohio in 1930, it proved feasible to tabulate the data for the rural population by an approximate index of economic status. It is the purpose of this paper to discuss the differences in the mortality rates of rural people living in counties of varying agricultural productivity.

The rural population of Ohio is far from homogeneous. In the northeastern part of the State and around the large industrial cities the rural population is mainly nonfarm, as defined by the census, and makes a livelihood in the adjacent cities. This nonfarm element of the rural population is supplemented by miners in the eastern and southern part of the State. The farm population falls into two fairly well-defined groups. North of the Ohio River is an area of marginal agricultural land, while northwestern Ohio lies adjacent to the corn belt, a productive agricultural section.

Since the mortality records did not record information which could be used in accurately subdividing the rural population by economic status, the counties were arranged in groups on the basis of census data and with the advice of members of the Department of Rural Economics of Ohio State University. Counties with a large proportion of rural-farm population were subclassified as having good, fair, and poor agriculture; counties with a large proportion of rural nonfarm population were subclassified as industrial or mining; a third group included with the rural-nonfarm counties was classed as mixed farm and nonfarm, since neither element of the population was predominant.

The mortality records for 1930 were then tabulated on the basis of this grouping of the counties of the State. All nonresident deaths were allocated to the place of residence. The data used throughout this paper refer to the native white population.

Tables 1 and 2 present the number of resident deaths per 1,000 population by age and sex for the rural native white population of the various groups of counties in Ohio for 1930. In the counties in which the rural population is mainly nonfarm, the mortality rates are, as a whole, lowest in the industrial and highest in the mining counties. This difference is less marked among females than among males. The largest differential exists at the younger ages; after age 55 the rates in the mining counties are no greater on the whole and, indeed,

are slightly less than the corresponding rates in the other nonfarm counties.

TABLE 1.—*Death rates per 1,000 population for native white* MALES *in different types of rural communities, Ohio, 1930*

Age	Total rural	Rural-farm				Rural-nonfarm			
		Total	Good agriculture	Fair agriculture	Poor agriculture	Total	Mining	Industrial	Mixed farm and nonfarm
Under 5	16.5	16.8	14.4	14.8	21.6	17.3	22.5	13.3	18.6
5-9	1.9	1.8	1.6	1.9	1.8	1.9	1.4	2.0	2.0
10-14	1.4	1.5	1.6	1.0	2.1	1.4	.9	1.6	1.4
15-19	2.2	1.6	1.1	1.8	1.7	2.7	2.9	2.5	2.8
20-24	3.6	3.6	3.1	3.7	3.9	3.6	5.5	2.8	4.1
25-29	3.7	4.0	3.2	3.9	4.6	3.4	5.0	3.0	3.5
30-34	3.4	3.3	1.5	4.3	3.0	3.5	5.4	2.6	4.4
35-44	4.9	4.5	3.6	4.7	4.8	5.2	9.4	4.6	4.6
45-54	7.6	7.2	6.9	7.6	6.9	7.8	9.6	7.8	7.2
55-64	16.8	16.6	15.9	17.9	15.1	17.0	17.4	17.6	16.3
65-74	43.8	43.8	42.6	44.4	43.7	43.9	42.8	47.2	40.2
75+	117.8	118.0	128.2	113.6	117.7	117.6	132.0	114.3	116.6
All ages	11.0	11.7	11.0	11.7	12.3	10.4	11.[illegible]	8.3	11.2
Adjusted rate[1]	8.7	8.6	7.9	8.5	9.2	[illegible]	[illegible]	[illegible]	8.9

[1] These and subsequent adjusted rates are [illegible] the age distribution of the standard million population of England and Wales, 1901.

TABLE 2.—*Death rates per 1,000 population for native white* FEMALES *in different types of rural communities, Ohio, 1930*

Age	Total rural	Rural-farm				Rural-nonfarm			
		Total	Good agriculture	Fair agriculture	Poor agriculture	Total	Mining	Industrial	Mixed farm and nonfarm
Under 5	13.8	14.0	12.9	13.0	16.4	13.7	19.0	10.7	16.3
5-9	1.5	1.7	1.1	1.9	1.6	1.4	1.5	1.2	1.6
10-14	1.3	1.3	.3	1.4	1.8	1.4	1.2	1.2	1.6
15-19	2.1	1.8	1.3	1.7	2.5	2.2	1.9	1.9	2.9
20-24	3.4	3.1	3.8	2.6	3.5	3.5	3.5	3.4	3.9
25-29	3.6	3.7	3.7	2.9	5.0	3.5	2.8	3.3	4.3
30-34	3.8	4.3	4.0	3.5	5.9	3.4	3.6	3.2	3.8
35-44	4.7	4.5	4.7	4.3	4.9	4.8	5.8	4.6	4.8
45-54	8.0	7.5	8.4	7.8	6.3	8.6	9.5	8.1	9.0
55-64	16.6	16.2	15.7	17.2	14.8	17.0	14.8	18.9	15.1
65-74	40.3	39.5	39.5	40.7	37.7	41.2	36.5	42.8	40.9
75+	121.7	110.1	121.1	123.0	115.1	123.5	107.9	132.1	119.0
All ages	10.5	11.1	10.6	11.1	11.7	9.9	9.8	9.2	11.1
Adjusted rate	8.3	8.0	8.0	8.1	8.6	8.4	8.6	8.1	8.8

These differences are in general agreement with what one would expect. In addition to the occupational hazards of mining, the population of these counties is, as a rule, further removed from adequate health and medical facilities and services than is the population in the industrial counties. That occupational hazards are important, however, is indicated by the fact that the difference in mortality rates is greater for males than it is for females.

In the counties in which the rural population is engaged mainly in farming, there is a negative correlation between the mortality

rate and agricultural productivity; that is, the death rate is lowest in the best agricultural areas. The largest differences are in the younger age groups; after age 45 the rates in the poor agricultural regions are no greater, and are even somewhat smaller than in the better farming counties.

The classification used in tables 1 and 2 is too detailed for comparison of specific causes of death. For this purpose the counties have been combined into two groups, one composed of counties in the poor agricultural and mining areas and representing relatively poor economic status, and another composed of the remainder of the counties representing relatively good economic status. Table 3 presents the mortality rates for these two groups.

TABLE 3.—*Death rates per 1,000 native white population by age and sex in different types of rural communities, Ohio, 1930*

Age	Male		Female		Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status		Good economic status	Poor economic status	Good economic status	Poor economic status
Under 5	14.0	20.5	11 8	16 9	35–44	4.4	[illegible]	4.5	5.0
5–9	1.9	1.8	1.4	1 6	45–54	7.6	7.5	6.7	[illegible]
10–14	1.4	1 5	1.1	1.6	55 64	17.4	15.9	17.6	14 9
15–19	2.0	2.4	1.7	2.6	65–74	43.1	41.9	41.3	38 9
20–24	3.2	4.3	3.2	3.7	75+	116.7	119 4	126.1	115.6
25–29	3.4	4.2	3 2	4.2	All ages	10.5	11.7	10.1	11.0
30–34	3.0	4.1	3.4	4.5	Adjusted rate	8.8	9.3	7.9	8.7

On the average, the death rates in the areas of poor economic status are about 10 percent greater than the corresponding rates in the areas of good economic status when adjustments are made for differences in age distribution of the populations involved. After age 55, however, the differential is reversed and the rates are higher in the good economic regions, except for males over 75 years of age.

That the death rate is greater in regions of poor economic status is not surprising. In such areas the wealth necessary to provide adequate health and medical facilities is usually lacking, standards of living are lower, and public health services are regarded as luxuries rather than necessities. It is interesting to observe that in the older age groups there is a fairly clear-cut tendency for mortality rates to be lower in the regions of poor economic conditions. It may be, as some have suggested, that under favorable health conditions a significant proportion of weaklings survive through adolescence and early adult life only to die at increasing rates when the diseases of late adult life begin to take their toll.

If differences in medical and health facilities and services play a part in bringing about the difference in mortality between persons living in counties with good economic conditions and those living in

counties with poor economic conditions, then the differences would be expected to be especially noticeable for diseases which are most easily prevented or cured. One such group of diseases comprises those associated with infant deaths. The data in table 4 show that the infant mortality rate is more than 40 percent greater in the poor economic areas. Although this is especially true for deaths due to diarrhea, enteritis, and the principal contagious diseases of childhood, it also exists for every cause except congenital malformations. The extremely high death rates from the principal contagious diseases and diarrhea and enteritis prevail throughout the entire first 5 years of life, with the rates in the regions of poor economic status between two and three times as large as the corresponding rates in the better economic areas (tables 5 and 6).

TABLE 4.—*White* INFANT DEATHS *and deaths per 1,000 live white births for selected causes of death in different types of rural communities, Ohio, 1930*

Cause of death	R[illegible]		[illegible]	
	Good economic status	Poor economic status	Good economic status	Poor economic status
Whooping cough, measles, scarlet fever, diphtheria	1.3	4.2	29	61
Influenza and pneumonia	7.9	11.6	177	170
Syphilis and gonorrhea	.4	.9	10	13
Diarrhea and enteritis	5.2	11.4	117	167
Congenital malformations	7.0	6.0	158	88
Premature birth	14.4	18.2	322	266
Birth injury	3.5	4.7	79	69
Accidents	1.3	3.3	29	49
Other causes	11.1	14.2	249	208
Total	52.2	74.5	1,170	1,091

TABLE 5.—*Death rates per 100,000 native white population by age and sex from* CHILDREN'S DISEASES [1] *in different types of rural communities, Ohio, 1930*

Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status
Under 5	59	172	59	134
5 and over	4	7	6	6
All ages	9	23	12	19

[1] Measles, whooping cough, scarlet fever, diphtheria.

TABLE 6.—*Death rates per 100,000 native white population by age and sex from* DIARRHEA AND ENTERITIS, *in different types of rural communities, Ohio, 1930*

Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status
Under 5	169	326	139	315
5 and over	4	6	4	8
All ages	20	35	17	40

In keeping with the differences observed in the death rates from all causes, the mortality from tuberculosis, influenza, pneumonia, and accidents is consistently greater in the poor economic regions during childhood, adolescence, and early adult life, but at advanced ages the differences are not so clear-cut (tables 7, 8, and 9). For females the mortality from tuberculosis is consistently lower throughout life in the better economic areas, with the greatest differences from 25 to 45 years of age. In the case of influenza, pneumonia, and accidents, female mortality rates are lower in the good economic regions until middle life but higher after those ages, although the differences are unimportant until age 65.

TABLE 7.—*Death rates per 100,000 native white population by age and sex from* TUBERCULOSIS *in different types of rural communities, Ohio, 1930*

	Male		Female		Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status		Good economic status	Poor economic status	Good economic status	Poor economic status
Under 15	7	10	11	7	55–64	80	63	42	79
15–24	27	43	62	78	65–74	[illegible]	97	112	128
25–34	50	60	68	110	75+	116	[illegible]	124	130
35–44	39	73	44	63	All ages	35	46	44	[illegible]
45–54	40	63	37	39	Adjusted rate	33	44	43	57

TABLE 8.—*Death rates per 100,000 native white population by age and sex from* INFLUENZA AND PNEUMONIA *in different types of rural communities, Ohio, 1930*

Age	Male		Female		Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status		Good economic status	Poor economic status	Good economic status	Poor economic status
Under 5	239	352	197	299	55–64	104	95	121	108
5–14	14	19	8	22	65–74	280	266	326	231
15–24	17	15	15	23	75+	909	1,018	1,279	1,176
25–34	36	34	20	29	All ages	89	106	91	108
35–44	33	36	28	38	Adjusted rate	76	91	74	89
45–54	53	63	53	70					

TABLE 9.—*Death rates per 100,000 native white population by age and sex from* ACCIDENTAL CAUSES *in different types of rural communities, Ohio, 1930*

Age	Male		Female		Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status		Good economic status	Poor economic status	Good economic status	Poor economic status
Under 5	71	152	88	102	55–64	167	112	42	39
5–14	60	51	33	39	65–74	229	258	178	157
15–24	113	146	33	36	75+	520	676	850	817
25–34	88	153	25	29	All ages	115	145	64	70
35–44	119	168	22	26	Adjusted rate	106	138	54	57
45–54	106	135	40	36					

There is more variability among males, however. Mortality rates from tuberculosis are definitely lower until age 55 in the good economic areas but no consistent pattern appears after that age. Except for the very young and the very old, under 5 years and over 75 years, there is no significant difference in mortality from influenza and pneumonia. At both ends of the life span, though, mortality is considerably higher among persons living in regions of poor economic conditions. Mortality from accidental causes, with the exception of ages 5 to 14 and 55 to 64, is definitely greater in the poor economic areas. Of course, part of this higher mortality results from mining accidents, but the differences are still significant even at the ages when such accidents are unimportant, especially under 5 years of age when the rates in the two areas differ more than 100 percent.

Until about 45 or 50 years of age there is little difference between the two regions in mortality from the principal diseases of late adult life, cancer, heart disease, cerebral hemorrhage, and nephri[illegible] tables the rates in the poor economic area tend to [illegible] rates from cancer, 10–13). After these ages, how[illegible] definitely greater in the regions of heart disease, and ne[illegible] with one or two exceptions. When the rates good econ[illegible] status [illegible] adjusted for differences in age distribution of the populations involved, the average rate is slightly higher in the good economic areas for each of these diseases except for heart disease among males where the rates are equal.

TABLE 10.—*Death rates per 100,000 native white population by age and sex from* CANCER *in different types of rural communities, Ohio, 1930*

Age	Male: Good economic status	Male: Poor economic status	Female: Good economic status	Female: Poor economic status
Under 35	5	4	4	6
35–44	27	27	61	77
45–54	62	75	172	193
55–64	223	182	355	291
65–74	537	465	573	500
75+	971	802	1,141	1,096
All ages	87	78	112	114
Adjusted rate	59	51	81	80

TABLE 11.—*Death rates per 100,000 native white population by age and sex from* CEREBRAL HEMORRHAGE *in different types of rural communities, Ohio, 1930*

Age	Male: Good economic status	Male: Poor economic status	Female: Good economic status	Female: Poor economic status
Under 45	5	3	6	7
45–54	66	58	95	73
55–64	188	185	234	239
65–74	676	760	767	773
75+	2,209	2,007	2,239	2,163
All ages	115	120	124	133
Adjusted rate	74	71	88	81

TABLE 12.—*Death rates per 100,000 native white population by age and sex from* HEART DISEASE *in different types of rural communities, Ohio, 1930*

Age	Male		Female		Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status		Good economic status	Poor economic status	Good economic status	Poor economic status
Under 25	11	13	13	13	65–74	1,301	1,191	1,083	1,030
25–34	24	28	29	43	75+	3,453	3,554	3,731	2,950
35–44	47	66	48	54	All ages	215	224	203	193
45–54	130	121	131	135	Adjusted rate	142	142	139	124
55–64	407	398	391	301					

TABLE 13.—*Death rates per 100,000 native white population by age and sex from* NEPHRITIS[1] *in different types of rural communities, Ohio, 1930*

Age	Male		Female		Age	Male		Female	
	Good economic status	Poor economic status	Good economic status	Poor economic status		Good economic status	Poor economic status	Good economic status	Poor economic status
Under 35	7	4	7	11	65–74	441	414	385	299
35–44	18	11	26	83	75+	[illegible]	[illegible]	1,010	977
45–54	52	56	61	52	All ages	83	83	70	[illegible]
55–64	188	161	161	121	Adjusted rate	56	51	49	47

[1] Includes other diseases of the kidneys and ureters.

Although these data offer only indirect evidence, they do essentially corroborate existing information concerning the relationship of mortality rates and economic status. The evidence must be regarded as indirect since it was impossible to classify families according to economic status. It undoubtedly is true that there were some families in the good economic regions whose income was insufficient to maintain what would generally be considered an adequate standard of living, just as there probably were families in the poor economic regions whose income was more than sufficient to maintain such a standard of living. The mortality rates in this paper represent not only the direct results of the economic status of a family upon the health of its members but also the effects arising from the ability of the community to maintain essential medical and health facilities. Because of the virtual absence of any information concerning the relationship of mortality rates and economic status in rural cases, it seemed desirable to present these data even though they are not as specific as might be desired.

Quite apart from the corroborating evidence of previous investigations, the results of the present study are in general agreement with *a priori* expectation. If, as is commonly believed, the decline in the death rate has been largely produced by the widespread application

of the principles of medicine, hygiene, and sanitation in combination with a rising standard of living, then the greatest differences between the mortality rates of persons living in regions of good economic status and those living in regions of poor economic status would be expected to occur for diseases most readily prevented by the application of these principles. The higher mortality rates in the poor economic regions for diseases of infancy, diarrhea, enteritis, tuberculosis, and the principal diseases of childhood, measles, whooping cough, scarlet fever, and diphtheria, are in keeping with expectation.

The fact that the death rates from the important diseases of late adult life are somewhat lower in the poor economic regions would appear at first sight to support the theory that modern medical and public health practices tend to lessen the effects of natural selection and to preserve a larger proportion of the weak and unfit than would otherwise be true. According to this theory, high death rates during infancy and childhood eliminate the least physically fit member[illegible] society so that attempts to decrease mortality at th[illegible]sury to examine ful, would weaken the race. It does, especially inasmuch as there is the validity of this theor[illegible] evidence pro or con. It is unquestionably true practically [illegible] modern health activities do preserve for many years the lives of many persons who under conditions existing a century ago would have succumbed at an early age to some disease which is now prevented or cured. Whether or not this affects the physical vigor of the race is a debatable question. At least very few persons recommend the cessation of medical care and public health services because of their alleged harmful effects upon the physical health of the population.

SUMMARY

It is commonly believed that health and economic status are directly related. Existing data confirm this belief, especially for the urban population. However, almost no information is available concerning either the total amount of illness or its variation among persons of different economic status in rural areas.

Mortality records for the rural native white population of Ohio were tabulated by counties divided into two groups, one group comprising counties in poor agricultural areas and the other comprising counties in good agricultural areas.

The standardized death rate in the poor economic areas was about 10 percent greater than the corresponding rate in the good economic areas. The difference was particularly noticeable at the younger ages; however, after age 55 the rates in the good agricultural areas were slightly greater.

The difference in mortality rates was greatest for the diseases which modern medical and public health practices have been most successful in controlling or preventing. The infant mortality rate was 52 per 1,000 live births in the good economic areas but 75 per 1,000 live births in the poor economic areas. The rates for the principal communicable diseases of childhood were from two to three times higher in the poor areas. Smaller but corresponding differences were reported for deaths due to tuberculosis, diarrhea and enteritis, accidents, and influenza and pneumonia.

The standardized mortality rates from cancer, cerebral hemorrhage, heart disease, and nephritis were slightly higher in the good economic areas. Before age 50 there was little or no difference in the rates for these diseases, but after that age the rates in the good economic areas were generally higher.

THE EFFECT OF SULFAPYRIDINE AND SULFANILAMIDE WITH AND WITHOUT SERUM IN EXPERIMENTAL MENINGOCOCCUS INFECTION [1]

By SARA E. BRANHAM, *Senior Bacteriologist, United States Public Health Service*

In 1937 Buttle, Gray, and Stephenson (*1*) and Proom (*2*) reported the protection of mice against meningococcus infection with sulfanilamide. Very soon afterward Branham and Rosenthal (*3*) described the apparently synergistic action of immune serum with sulfanilamide in such infections. This was almost immediately confirmed by Brown (*4*). Since then sulfanilamide has been used extensively in human cases of meningococcus infections. More recently sulfapyridine, introduced by Whitby (*5*), has been used similarly and there has been some discussion as to the relative merits of the two drugs. Few have used the drugs alone in a significant number of cases. Some of the most valuable reports on the use of drug alone have been those of Schwentker, Gelman, and Long (*6*), Willien (*7*), Carey (*8*), Hobson, Oxon, and MacQuaide (*9*), Muraz, Chirle, and Quéguiner (*10*), Craddock (*11*), Somers (*12*), and Bryant and Fairman (*13*). The last two reports include together nearly 1,000 cases, and indicate that drug therapy is to be a great boon in isolated places where serum has always been difficult to obtain. Muraz and Craddock used sulfanilamide exclusively, and Somers used sulfapyridine.

In most instances both serum and drug have been used and every imaginable variation in method has been employed. There have been a few reports in which carefully controlled groups of cases have been treated by a planned method, of which may be mentioned those

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[1] From the Division of Biologics Control, National Institute of Health

[2] Presented before Section VII of the Third International Congress for Microbiology in New York City, September 4, 1939.

of Banks (*14*), Waghelstein (*15*), Smith, Maxson, and Murphey (*16*), and Clyde and Neely (*17*). Each of these reports describes more than 100 cases, a total of about 500 cases, in which alternating groups were given serum only, drug only, and serum and drug. Antitoxin has been used more often than the usual antibacterial serum. In most of these studies the combination of the serum and drug has given most favorable results, although the difference has not always been conspicuous.

Almost every factor entering into clinical studies is variable and it is often difficult to evaluate the results unless a large number of cases is included. A quantitative study of these two drugs in meningococcus infections of mice and of their action with and without serum has seemed indicated. Our previous studies on the effect of combined serum and sulfanilamide therapy had been done with cultures varying greatly in virulence and with mice obtained from the open market. It was decided to standardize as much as possible the factors involved in the present studies.

Only pure line "CFW" (Swiss) mice inbred by brother-sister matings and weighing 16–20 grams have been used. Approximately an equal number of males and females were included.

The 6 strains of meningococci (3 of Group I and 3 of Group II) were kept at maximum virulence for mice throughout the whole period of study by daily transfer on rabbit blood agar and occasional passage through mice. The term "maximum virulence" means that from 2 to 10 meningococci suspended in mucin would kill a mouse weighing 16–20 grams in 48 hours. Our inbred mice became so susceptible that the concentration of the mucin in which the meningococci were suspended was reduced to 3.5 percent. The same lot of Wilson's granular mucin was used throughout. Five-hour cultures on rabbit blood agar slants were used. With a suspension containing approximately 2,000,000,000 meningococci as a starting point, 10-fold dilutions were made. At this rate dilution 10^{-9} should contain 2 meningococci. Obviously, wide variations are bound to occur, but a standard test dose of 1 cc. of 10^{-4} intraperitoneally was adopted and used throughout. This dose represented roughly 200,000 meningococci or 100,000 minimum fatal doses. The virulence of the culture was always checked in each test by including groups of control mice given 1 cc. of 10^{-7}, 10^{-8}, and 10^{-9} dilutions.

The same lots of sulfanilamide and sulfapyridine were used throughout these experiments. The drugs were suspended in 5-percent acacia and fed to the mice intragastrically by means of a child's size silver Eustachian tube catheter attached to a tuberculin syringe. The dose was usually contained in 0.2 cc. volume. A single dose was given. In the earlier experiments the drug was given immediately after the culture; later it was given 2 hours after the culture.

The sera used included 2 polyvalent antimeningococcic whole sera (horse), 2 polyvalent refined and concentrated sera (horse), 1 antitoxin (horse), 1 monovalent Group I rabbit serum, and 1 pooled normal horse serum. At least 3 dilutions were used in every experiment, and these were chosen on the basis of preliminary tests in mice. All were compared with our regular control antimeningococcic serum M 19, which was also used in many experiments. Serum dilutions were made in physiological salt solution and injected intraperitoneally in a volume of 0.5 cc. In the earliest experiments the serum was given before the culture; later it was given 2 hours after the infecting dose. This later plan was followed in the experiments reported here.

With both serum and drugs the dosage chosen was planned to be that which gave approximately 50 percent survival among the mice. Then the effect of the combination of serum and drug on the percentage of survival could be observed. In these studies of the protective activity of the two drugs, toxicity and rate of absorption were not considered.

The amounts of sulfanilamide and sulfapyridine that would protect approximately 50 percent of the mice to which a single dose was given by mouth were determined. The amount of drug required for this purpose was much less than has been used in other reported experiments where the protection of all mice was desired. Different strains of meningococci varied much in sensitivity to the drug, but in general 1 to 4 mg. of sulfanilamide, with an average dose of 2 mg., and 0.1 to 0.4 mg. of sulfapyridine, with an average dose of 0.2 mg., was the amount required. About ten times as much sulfanilamide as sulfapyridine was needed to protect 50 percent of the mice given 100,000 minimum fatal doses of meningococci. With sulfanilamide the amount of protection was in direct proportion to the size of the dose used. With sulfapyridine the same amount of protection was often observed to occur over a range of minute doses which were less than the amount required to protect all mice. Assuming that the drugs were completely absorbed by the mice, the concentration in the mouse would be less than might be expected to give a bacteriostatic action; that of sulfanilamide would be 1:10,000 and that of sulfapyridine 1:100,000. Neter (*18*) found some bacteriostatic action of sulfanilamide on meningococci in spinal fluid in a dilution of 1:10,000.

There was a great variation in the susceptibility of the individual strains of meningococci to the two drugs. Since all strains were at maximum virulence for mice, this difference, which was constant for each strain, could not be attributed to variation in virulence. Tables 1 and 2 show this difference. Strain 1041 (I) was most susceptible to both sulfanilamide and sulfapyridine. An amount of sulfanilamide that completely protected all mice against strain 1041

showed 80 percent mortality with 1027 of the same serological group. Strains 1054 (II) and 1037 (I) came next. Strains 1027 (I) and 963 (II) were fourth and fifth, and strain 1108 (II) was least susceptible. It seemed that the Group I strains were somewhat more susceptible to both drugs than the Group II strains, although No. 1054 (II) was an exception to this rule. In general, it may be said that gram for gram it required ten times as much sulfanilamide as sulfapyridine to protect a mouse of the weight used.

TABLE 1.—*Variation in response of 6 strains of meningococci to sulfanilamide* [1]

Strain	Percentage of deaths according to amount of sulfanilamide given				
	1 mg.	2 mg.	4 mg.	8 mg.	No drug
1027 I	80	10	10	0	100
1041 I	0	0	0	0	100
1037 I	40	0	0	0	90
963 II	60	60	0	0	100
1054 II	60	0	0	0	100
1108 II	80	60	60	60	90

[1] 100,000 minimum fatal doses of maximum virulence cultures.

TABLE 2.—*Variation in response of 6 strains of meningococci to sulfapyridine* [1]

Strain	Percentage of deaths according to amount of sulfapyridine given				
	0.1 mg.	0.2 mg.	0.4 mg.	0.8 mg.	No drug
1027 I	100	80	60	0	100
1041 I	80	40	0	0	90
1037 I	60	60	40	0	100
963 II	100	100	60	0	100
1054 II	60	80	0	0	100
1108 II	100	100	60	80	100
					100

[1] 100,000 minimum fatal doses of maximum virulence cultures.

It was expected that the different immune sera used would vary greatly in their protective action, and this was indeed the case. With the Group I strain (1027) used routinely by us in our regular mouse protection tests the amount of serum required to give 50 percent survival varied among the 6 sera used from as little as 0.000625 cc. to a point where 0.1 cc. failed to protect 50 percent of the mice. Table 3 shows the amounts of these sera required to protect 50 percent of the mice against infection with this Group I mouse strain.

Table 4 indicates the reaction of the six strains of meningococcus included in this study to a very good concentrated serum. One is struck immediately by the lower protection afforded the Group II strains as compared with those of Group I, although this serum is relatively richer in both agglutinins and precipitins for Group II than most polyvalent antimeningococcic sera. This is not a new obser-

vation. One is also struck by the variation in response of the individual strain of either serological Group to the same serum. Here the dilution giving 50 percent protection varies from 1—370 to less than 1—10 for the same serum with six strains of maximum virulence. The Group I strains responded to the serum in the following order: 1041, 1037, 1027. Among the Group II strains, 1054 is unaffected by serum, whereas 963 and 1108 respond to large doses. It is interesting to note that 1054 is most sensitive to the drug, though most serum resistant, of the Group II strains whereas 1108 responded very poorly to either drug when given alone in the doses used.

TABLE 3.—*Amounts of different antimeningococcic sera required to give 50 percent protection of mice against meningococcus 1027 I* [1]

Serum	Dilution	Survivals	Deaths	Accumulated		Percent survivals	Dilution for 50 percent survivals
				Survivals	Deaths		
A	1:50	8	2	16	2	89	
	1:100	6	4	8	6	57	1:112.
	[illegible]	2	8	2	14	13	(0.0044 cc).
B	[illegible]	2	8	12	8	60	
	1:120	[illegible]	[illegible]	10	14	42	1:89.
	1:240	6	[illegible]	[illegible]	18	25	(0.0056 cc).
C	1:60	[illegible]	1	[illegible]	[illegible]	95	
	1:120	8	2	13	3	[illegible]	1:200.
	1:240	5	5	5	8	38	[illegible]
D	1:400	8	2	16	2	89	
	1:800	4	6	8	8	50	1:800.
	1:1600	4	6	4	14	22	(0.000625 cc).
E	1:200	8	2	18	2	90	
	1:400	6	4	10	6	62	1:500.
	1:800	4	6	4	12	25	(0.001 cc).
F	1:10	0	10	0	10	0	
	1:20	0	10	0	20	0	
	1:40	0	10	0	30	0	
N	1:5	1	9	2	9	18	
	1:10	1	9	1	18	5	
	1:20	0	10	0	29	0	

[1] Dose=[illegible] minimum fatal doses.

TABLE 4.—*Variation among strains of meningococci in response to antimeningococcic serum B*

Strain	Dilution	Survivals	Deaths	Accumulated		Percent survivals	Dilution for 50 percent survivals
				Survivals	Deaths		
1027 I	1:60	2	8	12	8	60	
	1:120	4	6	10	14	42	
	1:240	6	4	6	18	25	1:89.
1037 I	1:100	7	3	21	3	87	
	1:200	7	3	14	6	70	
	1:400	7	3	7	9	44	1:340.
1041 I	1:120	5	5	20	5	80	
	1:240	9	1	15	6	71	
	1:480	6	4	6	10	37	1:370.
963 II	1:60	5	5	9	5	64	
	1:120	3	7	4	12	25	
	1:240	1	9	1	21	4.5	1:76.
1054 II	1:10	1	9	2	9	19	
	1:20	1	9	1	18	5.2	
	1:40	0	10	0	28	0	Less than 1:10.
1108 II	1:20	4	6	9	6	60	
	1:40	4	6	5	12	29	
	1:80	1	9	1	21	4.5	1:25.

Since the infecting strain may be resistant to serum and sensitive to drugs or resistant to drugs and sensitive to serum, both agents should be considered in treating clinical cases. Each strain is apparently a law unto itself.

Although there is great variation in individual strains in their reaction to the drug or serum when given separately, it was found that all strains responded better to the combination of the two agents. This was true when the serum and drug were given before or after the culture. In the experiments presented here the culture (100,000 minimum fatal doses) was given 2 hours before the serum and drug. As mentioned before, the culture suspended in mucin was given intraperitoneally, the serum intraperitoneally, and the single dose of drug, in acacia, by mouth. The amounts of drug and serum given approximated those that would show 50 percent protection when given alone. Some of the results are shown graphically in figures 1 to 10.

In figure 1 it is seen that 100,000 minimum fatal doses of [illegible] 1041 (I) kill all mice within 22 hours. The [illegible] mice, though pro- of sulfanilamide protected just the others. The combination of the longing somewhat [illegible] protected all mice. In figure 2 the effect of serum B and two [illegible] sulfanilamide on strain 1027 (I) is shown. All untreated mice died within 21 hours; 60 percent of those receiving serum and 40 percent of those receiving sulfanilamide succumbed, whereas all mice receiving the combination survived. In figure 3 a similar effect is shown when the same strain, 1027 (I), and serum B are used with sulfapyridine. Mortality with serum alone was 60 percent, with sulfapyridine alone 50 percent, and with the combination it was 0. In the next two figures the same strain is used, but with a polyvalent serum which gave practically no protection. Figure 4 shows the surprising result when sulfapyridine was combined with this serum. Mortality with culture or with serum was 100 percent, with sulfapyridine 30 percent, and with the combination it was 0. Figure 5 shows the complete protection afforded by combining serum F, which showed no protection, with sulfanilamide. The effect here of the combined agents is more than additive. Figure 6 shows similar results with Group II strain 963. This strain is resistant to both serum and drug and the protection was not complete even with combined sulfanilamide and serum.

Such results suggested that horse serum in itself might have some property of aiding drug therapy. Strains 1027 (I) and 963 (II) were tested with sulfanilamide, using a pooled normal horse serum (G) in various low dilutions. Figures 7 and 8 show that no protective effect above that given by the drug alone could be elicited. Appar-

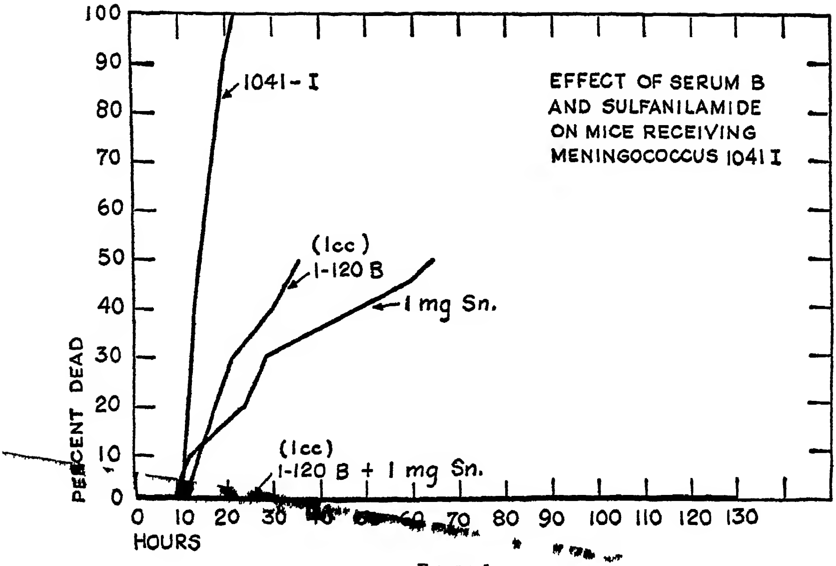

FIGURE 1

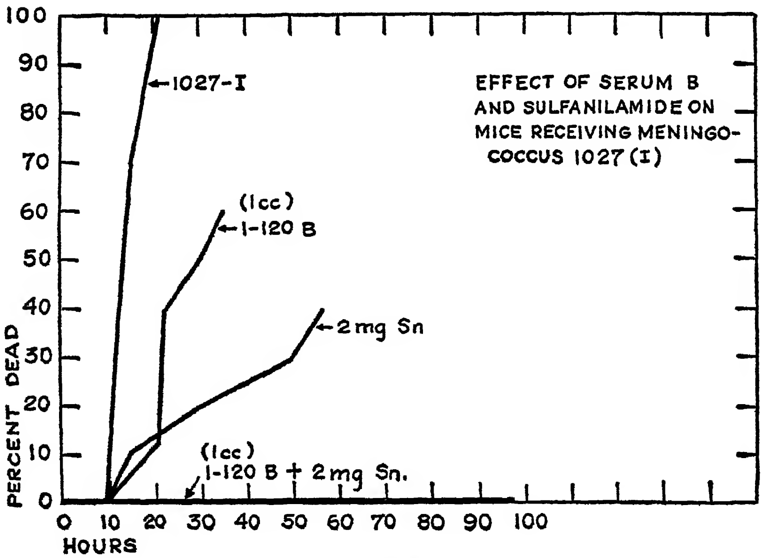

FIGURE 2

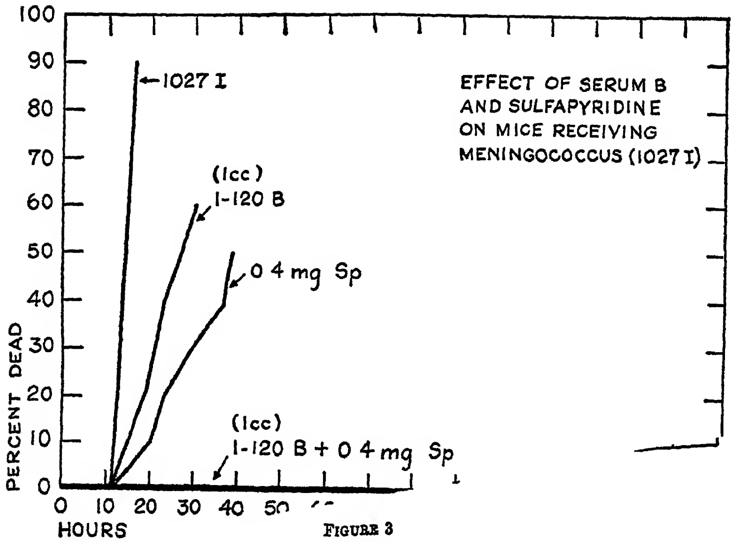

FIGURE 3

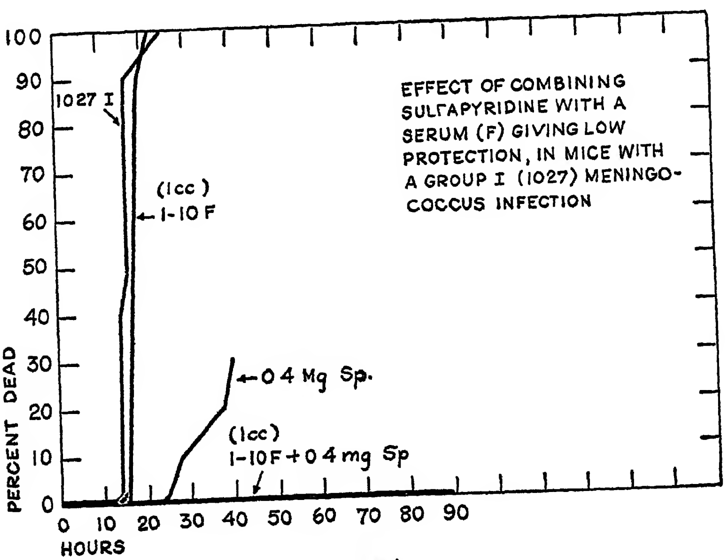

FIGURE 4

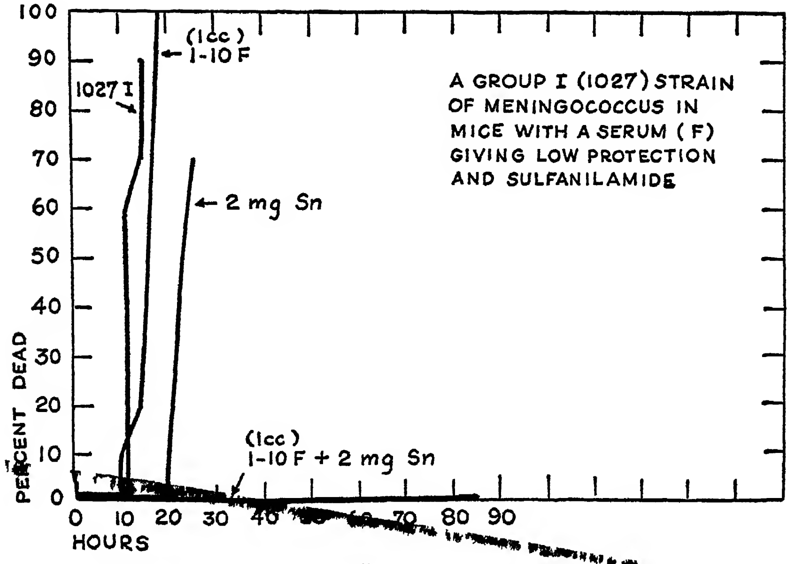

FIGURE 5

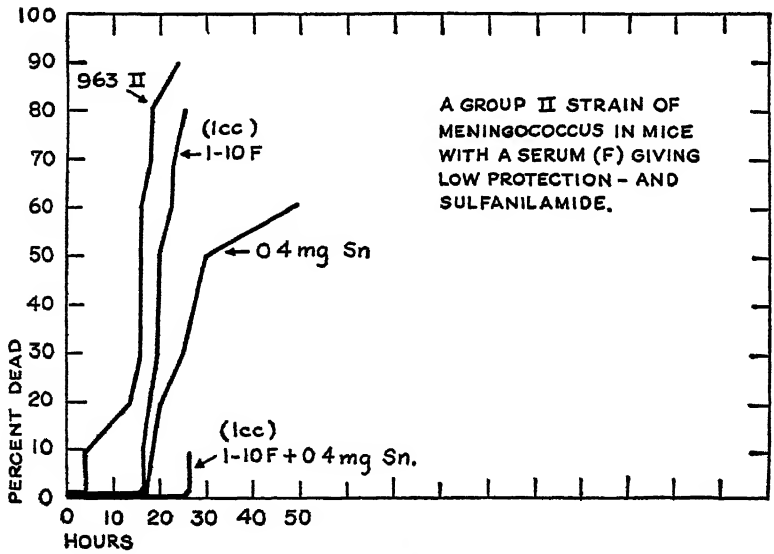

FIGURE 6

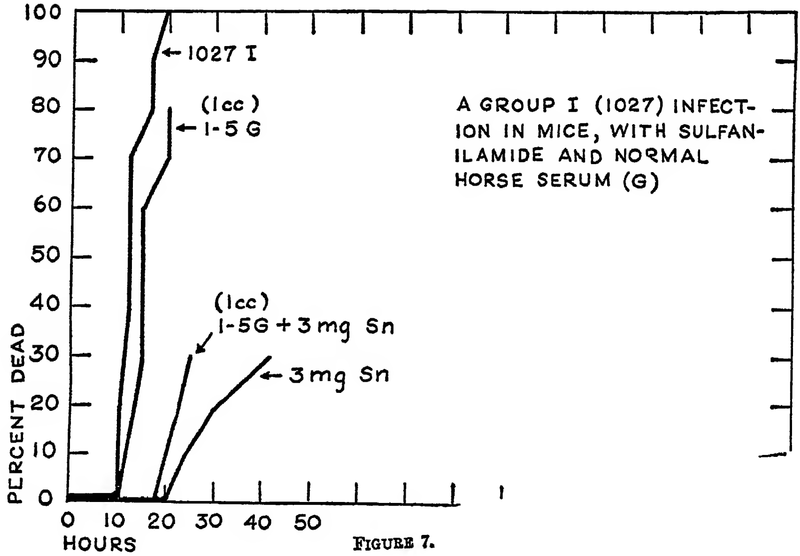

FIGURE 7.

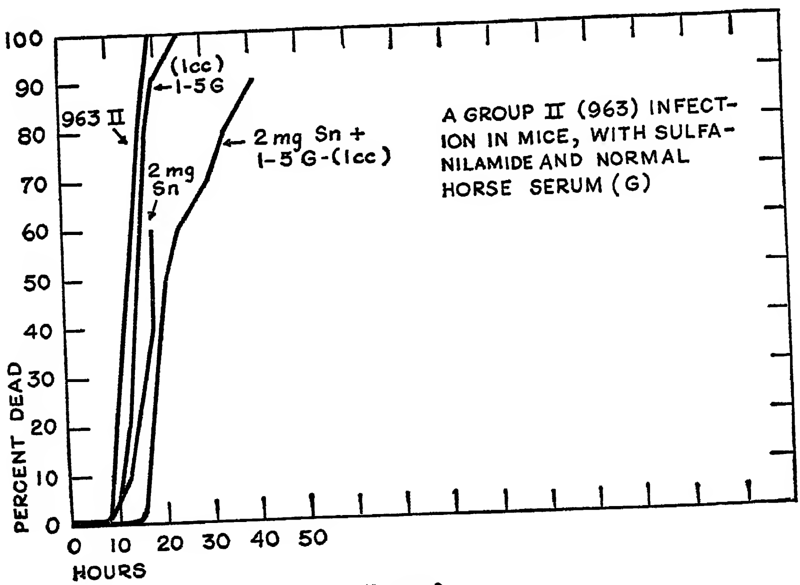

FIGURE 8

ently there is something in the serum of immunized horses, not present in normal serum, that reacts favorably with the drugs studied. Even a poor immune serum seems to be of value in protecting mice when the drugs are also given.

We know that Group II strains are usually less responsive to serum than Group I strains. Group II strains show more individual variation in their response to drugs.

Figure 9 shows a Group II strain (1108) that proved to be especially drug resistant both experimentally and clinically. The mortality with the drug and culture was almost equal to that among the untreated mice with the usual dosage. When the amount of serum B that gave a 50 percent mortality was also used, the mortality was reduced to 20 percent.

Figure 10 shows a Group II (1054) strain that is decidedly serum resistant, though quite drug susceptible. We see that the combination of sulfapyridine and serum in the amounts used gave a complete protection.

DISCUSSION

The [redacted] 75 experiments, each including about 200 mice. The [redacted] and constant and some of them seem well worth emphasizing at [redacted]

One interesting finding is the extremely small amounts of sulfanilamide and sulfapyridine that give some protection in mice. They have some degree of activity in concentration so low as to be at the limit of bacteriostatic action.

Weight for weight, sulfapyridine has shown a protective action against meningococcus infection in mice about ten times that of sulfanilamide under the conditions of the experiment. However the action of sulfapyridine has been somewhat less regular.

Individual strains of meningococci vary greatly in their response to the drugs, although those responding to treatment with sulfanilamide show a similar response to sulfapyridine and those resistant to one drug are also resistant to the other.

Likewise, there is a great difference in the response of individual strains to serum. For some strains, serum therapy has been more successful; for others the drugs have been far better. The case histories of the patients from whom the strains used in this study were isolated bear out this statement.

In all these experiments it has been consistently found that the combination of either of the drugs with serum has given results far better than with either agent alone. One of the serums had practically no protective action on any strain when used alone but marked protection could be obtained when it was given with the drugs.

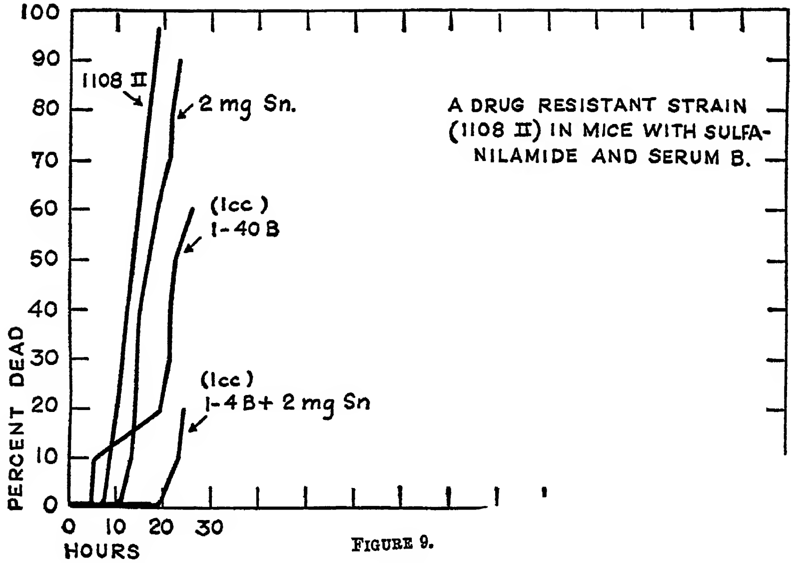

FIGURE 9.

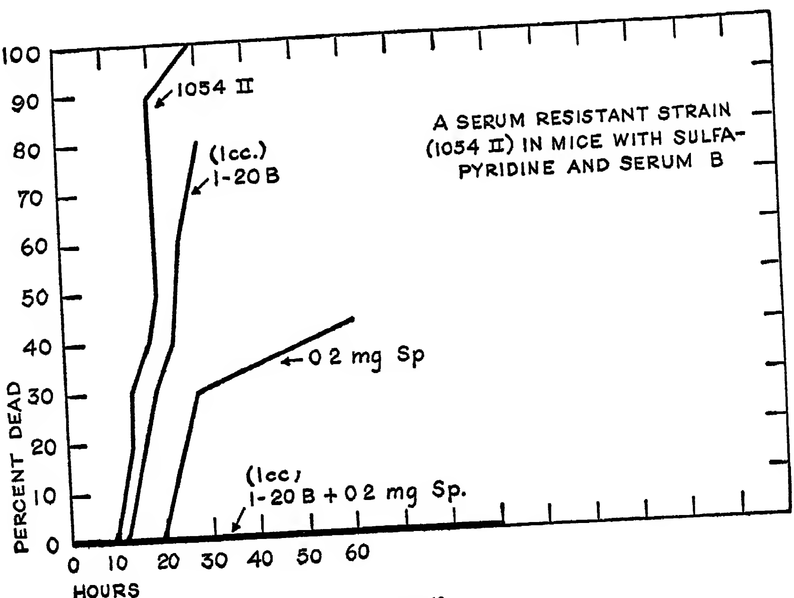

FIGURE 10.

Normal horse serum did not give this protection with the drugs. Apparently there is something in the serum of immunized horses, not measurable by the usual tests of antibodies, which acts with the drugs or is favorable to them.

The clinical histories associated with some of the strains of meningococci used are in accord with the findings of this study. Since there is such variation in response to serum and to drugs among various strains of meningococci, and since experimental infections with all strains respond so much better to the combination of drug and serum, it seems reasonable to treat patients with the combined therapy unless some contraindication is known. It is true that experiments with mice do not always mean that the same results will be obtained in man. But consistently good results in mice indicate that similar treatment should be given a fair trial in man.

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SOME NEW DATA ON THE DISTRIBUTION OF POLIOMYELITIS VIRUS

Although poliomyelitis does not stand high numerically in the list of human diseases from the standpoint of either the average numbers of cases reported annually or as a cause of death, it is one of the dreaded epidemic infections. It is feared largely because of the crippling which is frequently a distressing sequel and because of the feeling of insecurity that arises from the lack of a specific preventive measure. A safe and effective specific prophylactic procedure may ultimately be evolved, but so far this is a hoped-for prospect rather than an accomplished fact.

Recent investigations on the distribution ... virus ... or spread of the disease, may have a possible be... investigators differ. Members of the Department of Medicine of Yale University have recently demonstrated, for the first time, the presence of poliomyelitis virus in sewage.[1] Samples were collected from several localities in the city of Charleston, S. C., during the epidemic there in the summer of 1939. Inocula prepared from a sample taken from a pumping station at which sewage was received from a hospital where poliomyelitis patients were isolated caused experimental poliomyelitis in two monkeys, demonstrated by clinical symptoms and histologically in both animals and also in one animal by successful passage of the virus.

In another recent article,[2] the recovery of poliomyelitis virus from the stools of healthy contacts was reported. At least three such instances had been reported previously in the literature, and also the detection of a healthy carrier without history of contact with poliomyelitis cases. The facts developed from the study of this institutional outbreak, in which the virus of poliomyelitis was recovered from the stools of 3 out of 12 apparently healthy children in contact with cases and in a healthy adult nurse intimately associated with cases, support the theory that the infection is transferred by direct personal contact and offer corroborative evidence that the virus of poliomyelitis is probably spread throughout the general population by healthy carriers.

[1] Poliomyelitis virus in sewage. By John R. Paul, James D. Trask, and C. S. Culotta. Science, 90: 258–259 (September 15, 1939).
[2] Recovery of the virus of poliomyelitis from the stools of healthy contacts in an institutional outbreak. By S. D. Kramer, A. G. Gilliam, and J. G. Molner. Pub. Health Rep., 54: 1914–1922 (October 27, 1939).

DEATHS DURING WEEK ENDED DECEMBER 16, 1939

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Dec. 16, 1939	Corresponding week, 1938
Data from 88 large cities of the United States:		
Total deaths	8,432	8,597
Average for 3 prior years	[1] 8,876	
Total deaths, first 50 weeks of year	412,016	406,328
Deaths under 1 year of age	464	540
Average for 3 prior years	[1] 542	
Deaths under 1 year of age, first 50 weeks of year	24,787	26,169
Data from industrial insurance companies:		
Policies in force	66,440,030	68,278,453
Number of death claims	12,215	14,027
Death claims per 1,000 policies in force, annual rate	9.6	10.7
Death claims per 1,000 policies, first 50 weeks of year, annual rate	9.8	9.2

[1] Data for 86 cities.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS*

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

In these and the following tables, a zero (0) indicates a positive report and has the same significance as any other figure, while leaders (--) represent no report with the implication that cases or deaths may have occurred but were not reported to the State health officer

Cases of certain diseases reported by telegraph by State health officers for the week ended Dec. 23, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median

Division and State	Diphtheria: Dec. 23, 1939, rate	Diphtheria: Dec. 23, 1939, cases	Diphtheria: Dec. 24, 1938, cases	Diphtheria: 1934-38, median	Influenza: Dec. 23, 1939, rate	Influenza: Dec. 23, 1939, cases	Influenza: Dec. 24, 1938, cases	Influenza: 1934-38, median	Measles: Dec. 23, 1939, rate	Measles: Dec. 23, 1939, cases	Measles: Dec. 24, 1938, cases	Measles: 1934-38, median
[illegible]												
Maine	24	4	11	2	------	------	1	1	278	46	1	22
New Hampshire	0	0	6	0	------	------	------	------	20	2	------	24
Vermont	0	0	0	0	------	------	------	------	335	25	5	5
Massachusetts	6	5	4	7	------	------	------	------	209	178	196	195
Rhode Island	0	0	0	0	------	------	------	------	389	51	1	3
Connecticut	0	0	6	6	9	3	8	7	288	97	67	76
MID. ATL.												
New York	10	26	17	32	[1] 10	[1] 15	[1] 14	[1] 14	158	395	915	579
New Jersey	11	9	5	14	10	8	4	10	15	13	13	36
Pennsylvania	22	44	64	55	------	------	------	------	34	60	67	127
E. NO. CEN.												
Ohio	13	17	17	37	6	8	------	5	6	8	15	52
Indiana [2]	33	22	17	24	21	14	8	31	1	1	8	12
Illinois	26	39	27	40	9	14	25	34	14	21	15	27
Michigan [2]	5	5	9	11	5	5	------	1	218	206	253	111
Wisconsin	0	0	3	3	42	24	59	55	146	83	247	103
W. NO. CEN.												
Minnesota	0	0	2	3	6	3	2	------	60	31	289	54
Iowa	20	10	13	6	6	3	10	5	140	69	171	9
Missouri	30	23	10	22	6	5	59	85	8	6	2	15
North Dakota	0	0	5	2	190	26	6	3	15	2	336	14
South Dakota	30	4	9	4	15	2	1	------	23	3	128	2
Nebraska	0	0	2	5	------	------	1	------	4	1	5	5
Kansas	14	5	4	10	791	283	3	4	335	120	5	10
SO. ATL.												
Delaware	0	0	0	0	------	------	------	------	98	5	1	3
Maryland [3]	34	11	5	12	25	8	10	14	3	1	107	41
Dist. of Col.	8	1	6	10	8	1	3	3	16	2	3	3
Virginia [3]	28	15	35	30	62	33	111	------	7	4	49	49
West Virginia	24	9	10	19	40	15	18	43	13	5	12	43
North Carolina [4]	70	48	39	36	64	44	------	12	212	145	225	225
South Carolina [4]	19	7	3	3	4,474	1,638	236	230	3	1	3	7
Georgia [4]	25	15	10	14	1,619	975	68	68	15	9	28	0
Florida [4]	12	4	8	11	33	11	4	4	0	0	10	3

*Reports for two weeks are published in this issue, including the final week of 1939. Beginning in the next issue the publication of these reports will be advanced a week and will be for the week immediately preceding the week of issue.

Cases of certain diseases reported by telegraph by State health officers for the week ended Dec. 23, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Diphtheria				Influenza				Measles			
	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median
E. SO. CEN.												
Kentucky	16	9	12	15	7	4	35	34	2	1	8	60
Tennessee [4]	25	14	7	28	175	99	17	50	76	43	14	12
Alabama [4]	16	9	18	20	700	398	115	156	14	8	81	19
Mississippi [2]	23	9	4	5	------	------	------	------	------	------	------	------
W. SO. CEN.												
Arkansas	40	16	7	7	196	79	106	52	0	0	9	5
Louisiana [4]	27	11	0	13	2	1	10	12	2	1	36	17
Oklahoma	10	5	19	19	239	119	71	89	4	2	26	9
Texas [1,5]	70	84	47	74	495	597	427	427	70	85	34	39
MOUNTAIN												
Montana	0	0	3	3	2,865	306	----	-----	131	11	173	20
Idaho	0	0	2	1	------	------	12	4	20	2	83	13
Wyoming	22	1	4	1	327	15	------	------	202	12	3	2
Colorado	53	11	12	11	1,180	215	7	------	116	24	12	12
[illegible]	25	2	5	4	25	2	----	3	62	5	16	23
[illegible]	[illegible]	6	3	3	920	75	131	76	37	3	2	2
Utah	[illegible]	[illegible]	0	0	6,833	688	17	------	606	61	9	24
PACIFIC												
Washington	3	1	2	2	----	----	----	[illegible]	[illegible]	418	110	79
Oregon	10	2	0	1	497	100	12	39	184	[illegible]	[illegible]	13
California	18	22	42	33	107	131	23	35	156	190	702	[illegible]
Total	21	525	543	721	283	5,997	1,634	1,034	101	2,502	4,511	4,544
51 weeks	18	23,580	20,312	2 ,312	169	182,255	64,354	116,947	295	372,517	704,431	719,482

Division and State	Meningitis, meningococcus				Poliomyelitis				Scarlet fever			
	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median
NEW ENG.												
Maine	0	0	0	1	6	1	0	0	97	16	7	17
New Hampshire	0	0	0	0	0	0	0	0	0	0	9	8
Vermont	0	0	0	0	0	0	0	0	94	7	9	9
Massachusetts	0	0	1	2	2.4	2	0	0	103	88	137	178
Rhode Island	0	0	0	0	0	0	0	0	23	3	7	28
Connecticut	0	0	0	0	0	0	0	0	181	61	54	54
MID. ATL.												
New York	0.4	1	3	5	0.4	1	1	2	141	353	333	433
New Jersey	0	0	0	0	2.4	2	0	0	135	113	49	103
Pennsylvania	5	9	5	5	1	2	0	1	140	276	343	303
E. NO. CEN.												
Ohio	0.8	1	1	3	0.8	1	0	0	178	231	258	274
Indiana [1]	0	0	2	1	0	0	0	0	160	108	133	172
Illinois	0	0	0	7	0.7	1	0	1	212	323	355	509
Michigan [2]	0	0	0	1	2.1	2	0	1	311	294	442	341
Wisconsin	0	0	0	0	5	3	0	0	228	130	188	257
W. NO. CEN.												
Minnesota	0	0	0	1	1.9	1	0	1	231	119	8	140
Iowa	0	0	0	2	8	4	0	0	146	72	132	132
Missouri	1.3	1	1	1	0	0	0	0	165	128	81	101
North Dakota	0	0	0	0	0	0	0	0	161	22	9	25
South Dakota	0	0	0	0	8	1	0	0	30	4	17	23
Nebraska	0	0	0	0	8	2	0	0	61	16	12	40
Kansas	6	2	2	2	0	0	0	1	201	104	115	125

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended Dec. 23, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Meningitis, meningococcus				Poliomyelitis				Scarlet fever			
	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median
SO. ATL.												
Delaware	0	0	0	0	0	0	0	0	472	24	12	16
Maryland [3]	0	0	0	3	3	1	0	0	142	46	32	69
Dist. of Col.	0	0	0	0	0	0	0	0	81	10	7	10
Virginia [3]	0	0	0	3	1.9	1	0	1	58	31	20	39
West Virginia	11	4	4	2	16	6	1	1	196	73	71	75
North Carolina [4]	0	0	1	1	1.5	1	0	0	99	68	40	53
South Carolina [4]	2.7	1	1	0	0	0	0	0	30	11	10	5
Georgia [4]	0	0	0	0	0	0	0	0	73	44	21	20
Florida [4]	0	0	3	2	0	0	1	0	24	8	8	7
E. SO. CEN.												
Kentucky	0	0	3	3	3	2	0	0	94	54	63	60
Tennessee [4]	5	3	1	2	0	0	0	1	164	93	32	41
Alabama [4]	0	0	1	1	0	0	3	1	37	21	31	20
Mississippi [2]	0	0	1	1	0	0	1	0	15	6	8	[illegible]
W. SO. CEN.							υ	0	47	19	12	12
Arkansas	0	0	0	0	ɔ	0̄	1	1	27	11	22	16
Louisiana [4]	0	0	ΰ	3	8	4	0	0	46	23	48	36
Oklahoma	f.7	2	2	2	3	4	1	0	70	84	74	75
Texas [4, 5]												
MOUNTAIN												
Montana	9	1	0	0	0	0	0	0	281	30	23	33
Idaho	10	1	1	0	0	0	0	0	51	5	21	21
Wyoming	0	0	0	0	0	0	0	0	349	16	0	12
Colorado	14	3	3	0	10	2	0	0	241	50	24	51
New Mexico	0	0	0	0	12	1	0	0	334	27	16	24
Arizona	0	0	2	0	25	2	0	0	49	4	5	15
Utah [2]	0	0	1	1	10	1	0	0	149	15	13	55
PACIFIC												
Washington	0	0	1	2	0	0	0	1	167	54	48	49
Oregon	0	0	0	1	0	0	0	1	99	20	51	46
California	0	0	1	3	7	8	1	6	116	142	190	190
Total	1.2	30	41	81	2.3	58	10	33	138	3,457	3,599	4,783
51 weeks	1.5	1,931	2,781	5,307	6	7,270	1,690	7,230	124	158,500	183,025	218,448

Division and State	Smallpox				Typhoid and paratyphoid fever				Whooping cough		
	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934–38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases
NEW ENG.											
Maine	0	0	0	0	6	1	0	1	84	14	17
New Hampshire	0	0	0	0	0	0	0	0	71	7	1
Vermont	0	0	0	0	0	0	0	0	469	35	96
Massachusetts	0	0	0	0	0	0	1	1	87	74	176
Rhode Island	0	0	0	0	0	0	0	0	115	15	33
Connecticut	0	0	0	0	3	1	0	0	199	67	54
MID. ATL.											
New York	0	0	0	0	3	8	5	5	140	351	473
New Jersey	0	0	0	0	2	2	1	1	98	82	280
Pennsylvania	0	0	0	0	5	9	9	8	127	250	396

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended Dec. 23, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Smallpox				Typhoid and paratyphoid fever				Whooping cough		
	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934-38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases	1934-38, median	Dec. 23, 1939, rate	Dec. 23, 1939, cases	Dec. 24, 1938, cases
E. NO. CEN.											
Ohio	1	1	5	2	2	3	3	4	39	51	105
Indiana [2]	7	5	31	6	0	0	3	3	33	22	17
Illinois	0	0	3	2	1	1	7	6	47	71	341
Michigan [2]	0	0	6	1	2	2	2	4	117	111	203
Wisconsin	2	1	3	8	5	3	0	1	241	137	398
W. NO. CEN.											
Minnesota	37	19	15	11	0	0	0	1	81	42	14
Iowa	10	5	4	15	0	0	5	1	24	12	22
Missouri	1	1	9	4	5	4	4	4	26	20	25
North Dakota	0	0	1	5	0	0	0	0	15	2	4
South Dakota	38	5	4	4	8	1	0	0	0	0	3
Nebraska	11	3	1	1	0	0	0	0	8	2	2
Kansas	0	0	0	7	0	0	0	1	36	13	24
[illegible]											
Delaware	0	[illegible]	[illegible]	0	0	0	0	0	79	4	4
Maryland [2]	0	0	[illegible]	[illegible]	9	3	2	3	151	49	23
Dist. of Col	0	0	0	0	[illegible]	[illegible]	0	0	57	7	19
Virginia [3]	0	0	0	0	4	[illegible]	[illegible]	5	43	23	70
West Virginia	0	0	0	0	0	0	1	3	[illegible]	28	15
North Carolina [4]	0	0	0	0	1	1	0	1	53	30	[illegible]
South Carolina [4]	0	0	0	0	3	1	0	1	52	19	18
Georgia [4]	0	0	0	0	10	6	7	5	17	10	9
Florida [4]	0	0	0	0	0	0	1	1	12	4	34
E. SO. CEN.											
Kentucky	0	0	0	0	3	2	1	2	42	24	17
Tennessee [4]	2	1	0	0	4	2	0	2	56	32	19
Alabama [4]	4	2	0	1	0	0	3	3	2	1	36
Mississippi [2]	0	0	0	0	0	0	3	3	------	------	------
W. SO. CEN.											
Arkansas	10	4	0	0	7	3	3	2	10	4	29
Louisiana [4]	0	0	1	0	7	3	5	8	68	28	16
Oklahoma	10	5	7	1	0	0	2	2	0	0	5
Texas [4] [5]	4	5	2	3	18	22	20	16	88	106	21
MOUNTAIN											
Montana	9	1	0	1	0	0	0	1	56	6	0
Idaho	0	0	6	1	0	0	5	1	0	0	4
Wyoming	0	0	7	3	22	1	0	0	109	5	0
Colorado	221	46	5	5	0	0	1	1	53	11	32
New Mexico	0	0	0	0	37	3	3	3	519	42	30
Arizona	0	0	6	0	0	0	3	1	123	10	11
Utah [2]	20	2	0	0	0	0	0	0	397	40	18
PACIFIC											
Washington	0	0	0	17	0	0	0	2	12	4	10
Oregon	0	0	12	6	5	1	0	2	129	26	10
California	3	4	13	8	2	3	3	6	69	84	90
Total	4	110	141	163	4	89	106	135	80	1,981	3,376
51 weeks	7	[illegible]	14,200	7,307	10	12,630	14,127	14,930	135	170,367	207,289

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Rocky Mountain spotted fever, week ended Dec. 23, 1939, Virginia, 1 case.
[4] Typhus fever, week ended Dec. 23, 1939, 49 cases as follows: North Carolina, 2; South Carolina, 1; Georgia, 19; Florida, 3; Tennessee, 1; Alabama, 4; Louisiana, 4; Texas, 15.
[5] There were 28 new cases of diphtheria in Texas during the week ended July 15 instead of 119 as published in the Public Health Reports of July 28, 1939, p. 1397.

Cases of certain diseases reported by State health officers for the week ended Dec. 30, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median

Division and State	Diphtheria				Influenza				Measles			
	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median
NEW ENG.												
Maine	12	2	10	3	6	1	4	4	235	39	5	21
New Hampshire	0	0	1	0	------	------	------	------	122	12	0	24
Vermont	0	0	0	0	------	------	------	------	322	24	12	12
Massachusetts	2	2	6	6	------	------	------	------	225	191	180	122
Rhode Island	8	1	0	0	------	------	------	------	771	101	0	6
Connecticut	0	0	7	1	3	1	6	6	199	67	50	50
MID. ATL.												
New York	10	26	36	38	[1] 6	[1] 9	[1] 12	[1] 19	128	319	645	378
New Jersey	18	15	18	18	19	16	19	19	29	24	20	48
Pennsylvania	19	37	25	31	------	------	------	------	30	60	42	150
E. NO. CEN.												
Ohio	19	25	55	55	35	45	------	11	19	25	16	60
Indiana	19	13	18	26	12	8	12	45	7	5	8	8
Illinois	29	45	49	49	10	15	20	35	11	17	22	[illegible]
Michigan [2]	6	6	17	17	------	------	1	3	182	[illegible]	[illegible]	[illegible]
Wisconsin	0	0	3	6	53	30	44					
W. NO. CEN.												
Minnesota	15	9	3	5	4	2	4	------	130	67	541	32
Iowa	[illegible]	[illegible]	8	7	20	10	7	7	113	56	164	15
Missouri	3	2	14	33	1	1	29	67	3	2	3	12
North Dakota	7	1	3	2	175	24	12	------	22	3	135	1
South Dakota	15	2	2	1	30	4	7	1	30	4	260	2
Nebraska	0	0	2	2	------	------	2	------	8	2	3	4
Kansas	25	9	8	8	73	26	4	3	179	64	3	7
SO. ATL.												
Delaware	0	0	0	1	------	------	------	------	20	1	0	2
Maryland [3]	28	9	4	7	59	19	12	14	9	3	145	42
Dist. of Col	16	2	1	5	40	5	7	3	0	0	1	4
Virginia [3]	56	30	44	34	365	195	175	------	22	12	9	50
West Virginia	32	12	18	18	51	19	13	22	22	8	32	32
North Carolina [4]	35	24	38	35	121	83	4	14	95	65	306	306
South Carolina [4]	27	10	6	5	6,176	2,261	347	311	16	6	3	8
Georgia [4]	18	11	9	18	1,117	673	124	86	12	7	95	0
Florida [4]	6	2	9	9	66	22	3	2	6	2	13	7
E. SO. CEN.												
Kentucky	33	19	16	16	12	7	38	22	23	13	7	17
Tennessee	14	8	10	25	53	30	42	63	120	68	17	17
Alabama [4]	70	40	19	23	2,284	1,298	143	143	26	15	42	41
Mississippi [2] [4]	33	13	11	8	------	------	------	------	------	------	------	------
W. SO. CEN.												
Arkansas	37	15	15	15	233	94	208	36	0	0	44	18
Louisiana [4]	36	15	13	13	------	------	10	10	17	7	29	21
Oklahoma	28	14	15	15	253	126	123	114	8	4	9	4
Texas [4]	32	39	35	67	277	334	385	385	56	67	85	32
MOUNTAIN												
Montana	9	1	0	1	1,797	192	15	7	56	6	281	5
Idaho	0	0	3	0	10	1	5	5	898	88	25	21
Wyoming	0	0	1	0	2,509	115	------	------	44	2	18	1
Colorado	89	8	8	6	698	145	41	------	63	13	22	22
New Mexico	12	1	2	3	111	9	4	4	161	13	9	22
Arizona	25	2	2	2	1,251	102	120	78	110	9	2	2
Utah [2]	10	1	1	1	9,574	964	8	------	626	63	16	16

See footnotes at end of table.

Cases of certain diseases reported by State health officers for the week ended Dec. 30, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Diphtheria				Influenza				Measles			
	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median
PACIFIC												
Washington	6	2	3	3	6	2			974	316	139	69
Oregon	20	4	1	1	850	171	40	36	154	31	21	15
California [4]	16	19	39	40	31	38	26	40	157	191	835	66
Total	20	497	614	696	335	7,097	2,071	2,088	94	2,337	4,781	4,781
52 weeks	18	24,086	29,923	29,926	172	189,352	66,425	118,416	291	374,854	799,212	721,872

Division and State	Meningitis, meningococcus				Poliomyelitis				Scarlet fever			
	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median
NEW ENG.												
Maine	0	0	0	[illegible]	[illegible]	[illegible]	0	0	72	12	27	20
New Hampshire	0	0	0	0	0	0	[illegible]	[illegible]	30	3	10	12
Vermont	0	0	0	0	0	0	0	0	[illegible]	[illegible]	9	8
Massachusetts	0	0	1	1	2.4	2	0	0	140	119	124	[illegible]
Rhode Island	8	1	0	0	0	0	0	0	31	4	8	12
Connecticut	0	0	1	0	0	0	0	0	184	62	43	49
MID. ATL.												
New York	0	0	5	8	1.2	3	0	1	148	371	334	449
New Jersey	0	0	0	2	0	0	1	1	236	198	91	104
Pennsylvania	5	10	2	2	0.5	1	0	1	175	344	217	302
E. NO. CEN.												
Ohio	3	4	0	4	0.8	1	0	0	261	344	328	332
Indiana	0	0	0	1	0	0	0	0	174	117	165	165
Illinois	1.3	2	3	4	0.7	1	3	3	211	322	38	499
Michigan [2]	1.1	1	2	2	0	0	0	0	286	271	463	301
Wisconsin	0	0	0	1	0	0	0	0	276	157	192	258
W. NO. CEN.												
Minnesota	0	0	0	1	1.9	1	0	0	202	104	114	114
Iowa	0	0	0	0	6	3	0	0	324	160	82	102
Missouri	0	0	2	2	0	0	0	0	59	46	91	104
North Dakota	0	0	0	1	0	0	0	0	183	25	10	31
South Dakota	0	0	0	0	0	0	0	0	165	22	23	30
Nebraska	0	0	0	0	0	0	0	0	53	14	21	33
Kansas	2.8	1	0	1	2.8	1	0	0	198	71	148	148
SO. ATL.												
Delaware	0	0	0	0	0	0	0	0	138	7	8	8
Maryland [2]	0	0	0	2	0	0	0	0	188	61	29	56
Dist. of Col.	0	0	0	1	0	0	1	0	73	9	5	14
Virginia [3]	0	0	2	2	0	0	0	0	66	35	39	48
West Virginia	5	2	0	3	8	3	0	0	199	74	48	63
North Carolina [4]	1.5	1	2	1	1.5	1	0	0	64	44	43	43
South Carolina [4]	0	0	2	0	0	0	3	0	11	4	9	8
Georgia [4]	1.7	1	0	2	0	0	1	0	37	22	11	19
Florida [4]	0	0	2	2	0	0	1	1	33	11	10	10
E. SO. CEN.												
Kentucky	7	4	3	5	1.7	1	1	0	101	58	86	57
Tennessee	1.8	1	0	1	0	0	0	0	39	22	52	38
Alabama [4]	1.8	1	5	4	0	0	1	1	83	47	37	12
Mississippi [3, 4]	0	0	1	1	2.5	1	1	1	20	8	7	11

See footnotes at end of table.

Cases of certain diseases reported by State health officers for the week ended Dec. 30, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Meningitis meningococcus				Poliomyelitis				Scarlet fever			
	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median
W. SO. CEN.												
Arkansas	0	0	0	0	0	0	3	1	42	17	20	16
Louisiana [4]	0	0	1	1	0	0	0	0	36	15	8	14
Oklahoma	0	0	2	3	2	1	0	0	46	23	59	42
Texas [4]	0	0	0	2	0	0	3	2	40	48	104	104
MOUNTAIN												
Montana	0	0	0	0	0	0	0	0	225	24	12	16
Idaho	0	0	2	1	0	0	0	0	133	13	4	21
Wyoming	0	0	0	0	0	0	0	0	131	6	10	13
Colorado	0	0	0	0	0	0	0	0	101	21	49	49
New Mexico	0	0	0	0	25	2	0	0	185	15	21	17
Arizona	0	0	3	1	0	0	0	0	98	8	3	13
Utah [2]	0	0	0	0	0	0	0	0	70	7	15	53
PACIFIC												
Washington	3	1	0	0	9	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oregon	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
California [4]	0.8	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	28	20	35	141	3,552	3,497	4,977
52 weeks	1.5	1,962	2,824	5,390	6	7,298	1,710	7,276	124	162,052	186,532	223,425

Division and State	Smallpox				Typhoid and paratyphoid fever				Whooping cough		
	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases
NEW. ENG.											
Maine	0	0	0	0	0	0	0	1	260	43	42
New Hampshire	0	0	0	0	0	0	0	0	10	1	0
Vermont	0	0	0	0	13	1	0	0	402	30	63
Massachusetts	0	0	0	0	2	2	0	2	103	88	120
Rhode Island	0	0	0	0	0	0	0	0	46	6	20
Connecticut	0	0	0	0	0	0	0	0	131	44	43
MID. ATL.											
New York	0	0	0	0	2	4	6	7	157	391	410
New Jersey	0	0	0	0	4	3	3	3	138	116	813
Pennsylvania	0	0	0	0	4	7	9	7	155	306	252
E. NO. CEN.											
Ohio	2	2	6	3	7	9	3	4	116	151	76
Indiana	0	0	38	5	0	0	1	1	21	14	3
Illinois	0	0	5	5	7	10	1	3	69	106	315
Michigan [2]	0	0	4	1	7	7	6	1	110	104	266
Wisconsin	18	10	5	7	4	2	1	0	206	117	270
W. NO. CEN.											
Minnesota	54	28	19	17	0	0	1	1	60	81	7
Iowa	45	22	12	7	0	0	6	4	45	22	18
Missouri	0	0	20	9	1	1	3	6	4	3	11
North Dakota	0	0	0	5	0	0	0	0	15	2	7
South Dakota	30	4	9	5	0	0	0	0	0	0	2
Nebraska	4	1	6	10	0	0	1	0	4	1	7
Kansas	0	0	0	6	8	1	0	1	22	8	11

See footnotes at end of table.

Cases of certain diseases reported by State health officers for the week ended Dec. 30, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Smallpox				Typhoid and paratyphoid fever				Whooping cough		
	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases	1934–38, median	Dec. 30, 1939, rate	Dec. 30, 1939, cases	Dec. 31, 1938, cases
SO. ATL.											
Delaware	0	0	0	0	0	0	0	0	118	6	0
Maryland [1]	0	0	0	0	9	8	3	4	142	46	33
Dist. of Col.	0	0	0	0	8	1	0	1	81	10	12
Virginia [3]	0	0	0	0	11	6	0	5	39	21	62
West Virginia	5	2	1	0	3	1	1	1	35	13	36
North Carolina [4]	0	0	0	0	1	1	3	6	64	44	144
South Carolina [4]	0	0	0	0	0	0	7	1	52	19	25
Georgia [4]	0	0	1	0	10	6	7	5	3	2	16
Florida [4]	0	0	0	0	3	1	3	2	6	2	9
E. SO. CEN.											
Kentucky	0	0	0	0	0	0	4	3	134	77	5
Tennessee	0	0	0	0	4	2	2	5	19	11	15
Alabama [4]	0	0	0	0	2	1	6	7	42	24	34
Mississippi [2] [4]	0	0	0	0	0	0	1	2	----	----	----
Arkansas	[illegible]	[illegible]	[illegible]	[illegible]	12	5	2	8	5	2	10
Louisiana [4]	0	0	[illegible]	[illegible]	[illegible]	[illegible]	4	4	27	11	5
Oklahoma	16	8	22	1	[illegible]	[illegible]	[illegible]	5	0	0	10
Texas [4]	3	4	7	8	9	11	4	[illegible]	[illegible]	79	52
MOUNTAIN											
Montana	0	0	5	10	0	0	0	0	47	5	18
Idaho	0	0	6	3	0	0	3	0	20	2	2
Wyoming	0	0	0	1	0	0	0	0	305	14	3
Colorado	82	17	1	1	5	1	4	0	53	11	25
New Mexico	0	0	0	0	62	5	1	4	259	21	13
Arizona	12	1	8	0	0	0	3	2	49	4	4
Utah [2]	20	2	0	0	10	1	0	0	516	52	15
PACIFIC											
Washington	12	4	2	11	0	0	0	1	15	5	10
Oregon	5	1	5	5	0	0	0	0	199	40	11
California [4]	2	3	8	8	2	2	3	8	80	97	63
Total	5	118	197	193	4	106	104	129	89	2,202	2,924
52 weeks	7	9,574	14,397	7,490	10	12,736	14,231	15,059	134	172,569	210,213

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Rocky Mountain spotted fever, week ended Dec. 30, 1939, Virginia, 1 case.
[4] Typhus fever, week ended Dec. 30, 1939, 36 cases as follows: North Carolina, 2; South Carolina, 4; Georgia, 10; Florida, 5; Alabama, 4; Mississippi, 4; Louisiana, 4; Texas, 2; California, 1.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week.

State	Diphtheria	Influenza	Malaria	Measles	Meningitis, meningococcus	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid and paratyphoid fever
November 1939										
Colorado	31	133		105	1		21	141	19	7
Georgia	148	587	293	21	2	9	1	142	1	80
Kansas	32	27	1	262	0		2	430	1	10
Louisiana	62	35	32	5	7	7	1	76	2	50
Maine	11	2		94	0		0	52	0	7
Mississippi	93	4,580	2,266	160	4	233	2	57	0	12
Montana	4	327		86	0		0	155	0	1
Nebraska	10	5		6	0		13	65	2	4
New Mexico	11	5	2	12	2		11	40	0	11
New York	54		10	814	11		78	882	0	40
North Dakota	4	17		7	0		1	104	0	1
Ohio	201	113		106	1		16	1,125	4	27
Oklahoma	71	195	95	9	2	7	10	89	12	23
Tennessee	133	134	53	40	3	17	1	331	5	21

November 1939

	Cases
Chickenpox:	
Colorado	225
Georgia	[illegible]
Kansas	36
Louisiana	216
Maine	350
Mississippi	268
Montana	57
Nebraska	99
New Mexico	1,904
New York	86
North Dakota	1,243
Ohio	44
Oklahoma	88
Tennessee	
Conjunctivitis, acute infectious:	
Georgia	4
New Mexico	1
Dengue:	
Georgia	4
Diarrhea:	
New Mexico	4
Ohio (under 2 years; enteritis included)	25
Dysentery:	
Colorado (bacillary)	2
Georgia (amoebic)	5
Georgia (bacillary)	19
Georgia (unspecified)	2
Kansas	5
Louisiana (amoebic)	6
Louisiana (bacillary)	1
Maine (bacillary)	1
Mississippi (amoebic)	113
Mississippi (bacillary)	246
New Mexico (amoebic)	2
New Mexico (bacillary)	9
New York (amoebic)	8
New York (bacillary)	71
Ohio (amoebic)	1
Ohio (bacillary)	2
Oklahoma (bacillary)	13
Tennessee (amoebic)	5
Tennessee (bacillary)	11
Encephalitis, epidemic or lethargic:	
Colorado	1
Kansas	5
Montana	43
New Mexico	2
New York	7
Ohio	2
German measles:	
Kansas	[illegible]
[illegible]	1
New Mexico	4
New York	51
North Dakota	3
Ohio	19
Tennessee	1
Hookworm disease:	
Georgia	4,108
Louisiana	6
Mississippi	697
Tennessee	8
Impetigo contagiosa:	
Kansas	11
Montana	9
Ohio	39
Tennessee	20
Lead poisoning:	
Ohio	8
Leprosy:	
Mississippi	1
Oklahoma	1
Mumps:	
Colorado	113
Georgia	44
Kansas	107
Louisiana	10
Maine	6
Mississippi	210
Montana	108
Nebraska	86
New Mexico	28
North Dakota	99
Ohio	356
Oklahoma	11
Tennessee	13
Ophthalmia neonatorum:	
Mississippi	2
New York	13
Oklahoma	2
Tennessee	3
Puerperal septicemia:	
Mississippi	23
New Mexico	2
Ohio	4
Tennessee	1
Rabies in animals:	
Louisiana	6
Mississippi	2
New Mexico	3
New York[1]	10
[illegible] spotted fever:	
[illegible]	1
Scabies:	
Kansas	20
Montana	2
Screw worm infection:	
Georgia	1
Septic sore throat:	
Colorado	1
Georgia	43
Kansas	17
Louisiana	6
Montana	3
Nebraska	2
New Mexico	11
New York	77
Ohio	10
Oklahoma	29
Tennessee	19
Tetanus:	
Georgia	1
Kansas	1
Louisiana	6
New York	5
Ohio	2
Oklahoma	2
Tennessee	1
Trachoma:	
Mississippi	3
Montana	2
North Dakota	4
Ohio	13
Oklahoma	169
Tennessee	1
Trichinosis:	
New York	16
Tularaemia:	
Colorado	2
Georgia	2
Kansas	58
Louisiana	2
New York	2
Ohio	13
Oklahoma	1
Tennessee	1
Typhus fever:	
Georgia	113
Louisiana	10
Mississippi	[illegible]
New York	[illegible]
Tennessee	[illegible]

[1] Exclusive of New York City.

Summary of monthly reports from States—Continued

November 1939—Continued

	Cases
Undulant fever:	
Colorado	3
Georgia	5
Kansas	9
Louisiana	3
Maine	1
Mississippi	2
Montana	1
New York	27
Ohio	9
Oklahoma	11
Tennessee	4
Vincent's infection:	
Kansas	11
Maine	2
New York [1]	56
North Dakota	3
Oklahoma	5
Tennessee	31
Whooping cough:	
Colorado	45
Georgia	48
Kansas	60
Louisiana	107
Maine	159
Mississippi	727
Montana	12
Nebraska	18
New Mexico	80
New York	1,444
North Dakota	81
Ohio	620
Oklahoma	9
Tennessee	199

[1] Exclusive of New York City.

WEEKLY REPORTS FROM CITIES

City reports for week ended Dec. 16, 1939

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
[illegible]											
Current [illegible]	[illegible]	256	60	1,088	717	1,350	17	345	26	1,047	--------
[illegible]	[illegible]	[illegible]	29	666	458	1,007	0	329	16	726	--------
Maine:											
Portland	0	--------	0	8	1	1	0	[illegible]	0	3	23
New Hampshire:											
Concord	0	--------	0	0	1	0	0	0	0	0	14
Manchester	0	--------	0	0	3	0	0	0	0	0	24
Nashua	0	--------	0	1	0	0	0	0	0	0	2
Vermont:											
Barre	0	--------	0	0	0	0	0	0	0	5	3
Burlington	0	--------	0	1	0	0	0	0	0	9	8
Rutland	0	--------	0	0	0	0	0	0	0	0	8
Massachusetts:											
Boston	0	--------	1	59	16	28	0	6	0	31	234
Fall River	0	--------	0	0	2	0	0	0	0	25	34
Springfield	0	--------	0	1	0	0	0	1	0	12	40
Worcester	0	--------	0	1	8	6	0	1	0	3	50
Rhode Island:											
Pawtucket		--------	0	0	0	1	0	0	0	0	20
Providence	1	--------	1	80	6	9	0	1	0	14	78
Connecticut:											
Bridgeport	0	--------	0	1	1	3	0	2	0	0	25
Hartford	0	--------	0	0	0	6	0	2	0	24	41
New Haven	0	--------	0	0	1	3	0	0	0	14	47
New York:											
Buffalo	0	--------	0	7	8	12	0	6	0	6	126
New York	19	29	2	25	71	123	0	79	2	85	1,425
Rochester	0	--------	0	0	0	10	0	0	0	5	42
Syracuse	2	--------	0	0	3	1	0	4	0	28	57
New Jersey:											
Camden	0	--------	0	0	3	11	0	0	0	1	33
Newark	0	4	0	0	7	16	0	3	0	34	94
Trenton	1	--------	0	0	2	1	0	1	0	0	25
Pennsylvania:											
Philadelphia	6	5	3	4	16	49	0	18	1	57	478
Pittsburgh	4	3	4	4	9	26	0	5	0	7	161
Reading	1	--------	0	2	2	0	0	0	2	2	22
Scranton	0	--------	--------	0	--------	5	0	--------	0	0	--------
Ohio:											
Cincinnati	11	--------	1	0	3	22	0	5	0	4	135
Cleveland	1	15	0	0	16	33	0	10	0	21	180
Columbus	5	--------	0	1	7	3	0	2	0	6	84
Toledo	0	1	0	1	1	15	0	6	0	6	78
Indiana:											
Anderson	0	--------	0	0	2	0	0	0	0	0	9
Fort Wayne	0	--------	0	0	2	6	0	0	0	0	25
Indianapolis	3	--------	0	2	8	24	0	5	0	4	120
Muncie	0	--------	0	0	1	1	0	0	0	0	10
South Bend	0	--------	0	1	1	1	0	0	0	1	15
Terre Haute	0	--------	0	0	1	0	0	0	0	0	23

[1] Figures for Boise estimated; report not received.

City reports for week ended Dec. 16, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Illinois:											
Alton	0	1	1	0	0	2	0	0	0	0	8
Chicago	6	13	0	12	37	174	0	35	0	29	709
Elgin	1	--------	0	0	2	4	0	0	0	1	12
Moline	0	--------	0	0	0	3	0	0	0	0	9
Springfield	0	--------	0	0	4	0	0	0	0	3	26
Michigan:											
Detroit	5	1	0	10	25	74	0	12	0	30	274
Flint	0	--------	0	1	4	9	0	0	0	15	20
Grand Rapids	0	--------	0	1	3	21	0	0	0	4	45
Wisconsin:											
Kenosha	0	--------	0	0	1	1	0	0	0	0	10
Madison	0	--------	0	0	0	4	0	0	0	11	11
Milwaukee	0	--------	0	2	2	45	0	8	0	11	108
Racine	0	--------	0	0	0	2	0	0	0	10	10
Superior	0	--------	0	0	0	3	0	0	0	0	6
Minnesota:											
Duluth	0	--------	0	38	1	1	0	0	0	0	34
Minneapolis	0	--------	0	3	7	20	0	0	0	12	101
St. Paul	0	--------	0	3	5	15	0	2	0	34	67
Iowa:											
Cedar Rapids	1	--------	--------	2	--------	1	0	--------	0	1	--------
Davenport	2	--------	--------	1	--------	9	0	--------	0	0	--------
Des Moines	0	--------	0	25	0	11	2	0	0	0	--------
Sioux City	0	--------	--------	0	--------	6	0	--------	0	2	--------
Waterloo	2	--------	--------	0	--------	8	0	--------	[illegible]	[illegible]	--------
Missouri:											
Kansas City	0	--------	1	[illegible]	[illegible]	24	0	4	0	0	97
St. Joseph	0	--------	1	0	4	2	0	0	0	0	25
St. Louis	[illegible]	----	1	2	4	26	0	6	1	10	187
North Dakota:											
Fargo	0	--------	0	0	1	0	0	0	0	0	9
Grand Forks	0	--------	--------	0	--------	4	0	--------	0	3	--------
Minot	0	--------	0	1	0	1	0	0	0	0	5
South Dakota:											
Aberdeen	1	--------	--------	0	--------	1	0	--------	0	0	--------
Sioux Falls	0	--------	0	1	0	6	0	0	0	0	12
Nebraska:											
Omaha	0	--------	0	0	4	3	0	1	0	3	57
Kansas:											
Lawrence	0	7	0	0	1	0	0	0	0	0	6
Topeka	0	1	1	0	0	4	0	1	0	0	11
Wichita	1	--------	0	30	2	1	0	0	0	2	0
Delaware:											
Wilmington	1	--------	0	0	3	3	0	0	0	5	36
Maryland:											
Baltimore	4	7	0	2	14	6	0	12	2	51	209
Cumberland	0	--------	0	0	1	0	0	0	0	0	5
Frederick	0	--------	0	0	0	0	0	0	0	0	3
District of Columbia:											
Washington	1	--------	0	0	10	12	0	10	1	19	155
Virginia:											
Lynchburg	2	--------	0	0	1	2	0	0	0	6	10
Norfolk	0	6	0	0	3	1	0	1	0	0	21
Richmond	1	--------	1	11	6	4	0	2	0	2	63
Roanoke	0	--------	0	1	0	3	0	0	0	0	15
West Virginia:											
Charleston	0	--------	0	0	1	1	0	0	0	1	27
Huntington	1	--------	--------	0	--------	0	0	--------	0	0	--------
Wheeling	0	--------	0	2	5	3	0	1	0	1	26
North Carolina:											
Gastonia	0	--------	--------	0	--------	0	0	--------	0	0	--------
Raleigh	1	--------	0	0	0	1	0	1	0	0	3
Wilmington	1	--------	0	0	3	0	0	1	0	0	15
Winston-Salem	0	1	0	0	1	2	0	1	0	0	10
South Carolina:											
Charleston	1	42	0	0	2	1	0	1	0	0	18
Florence	4	15	0	0	1	2	0	1	0	0	11
Greenville	0	--------	0	0	1	0	0	0	0	0	17
Georgia:											
Atlanta	1	28	0	9	6	9	0	3	0	0	78
Brunswick	0	--------	0	0	0	1	0	0	0	0	3
Savannah	1	16	0	0	4	3	0	2	0	0	40
Florida:											
Miami	1	3	0	1	5	1	0	2	0	0	39
Tampa	1	2	2	0	0	0	0	0	0	0	28

City reports for week ended Dec. 16, 1939—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Kentucky:											
Ashland	0		0	0	1	0	0	0	0	1	6
Covington	0	1	0	0	0	1	0	1	0	0	20
Lexington	1		0	0	0	2	0	1	0	6	17
Louisville	0		0	2	10	12	0	8	0	32	77
Tennessee:											
Knoxville	1		0	0	1	9	0	1	0	0	25
Memphis	0		3	1	4	9	0	4	0	6	77
Nashville	0		0	12	5	3	0	4	0	2	45
Alabama:											
Birmingham	4	13	2	0	8	8	0	5	1	0	79
Mobile	0		2	0	2	2	0	0	0	0	34
Montgomery	0	15		1		3	0		0	0	
Arkansas:											
Fort Smith	0			0		0	0		1	0	
Little Rock	0	3	0	0	3	1	0	1	0	3	14
Louisiana:											
Lake Charles	0		0	0	2	0	0	0	0	0	7
New Orleans	5	2	2	0	17	18	0	11	1	0	180
Shreveport	1		0	0	10	0	0	2	0	0	33
Oklahoma:											
Oklahoma City	1		0	0	4	1	0	1	0	0	41
Tulsa	0			2		4	0		0	0	
Texas:											
[illegible]	5		0	0	4	8	0	8	0	0	72
Fort Worth	[illegible]	[illegible]	0	0	2	6	0	0	0	11	34
Galveston	[illegible]	[illegible]	[illegible]	0	1	0	0	1	0	0	14
Houston	3		[illegible]	[illegible]	[illegible]	5	0	2	0	0	69
San Antonio	1	12	0	[illegible]	[illegible]	[illegible]	[illegible]	6	0	0	67
Montana:											
Billings	0		0	0	0	0	0	0	0	0	12
Great Falls	0		0	1	0	0	0	0	0	0	9
Helena	0		0	0	0	2	0	0	0	0	5
Missoula	0		0	0	0	0	0	0	0	6	7
Idaho:											
Boise											
Colorado:											
Colorado Springs	0		0	0	5	3	0	1	0	1	12
Denver	4		0	4	2	8	0	0	0	4	79
Pueblo	0		0	1	1	2	0	0	0	0	15
New Mexico:											
Albuquerque	0		0	0	4	1	0	2	0	2	16
Utah:											
Salt Lake City	1		0	20	4	5	0	2	0	30	35
Washington:											
Seattle	0		0	17	3	4	0	5	1	2	83
Spokane	0	1	1	2	1	7	0	0	0	1	27
Tacoma	0		0	224	0	2	0	0	0	0	26
Oregon:											
Portland	0	1	0	6	1	2	0	2	0	5	82
Salem	0			4		0	0		0	0	
California:											
Los Angeles	3	12	0	5	13	36	0	21	2	14	345
Sacramento	1		1	0	3	1	0	0	1	0	28
San Francisco	0	1	0	3	5	14	0	12	1	18	187

City reports for week ended Dec. 16, 1939—Continued

State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Polio-mye-litis cases	State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Polio-mye-litis cases
Rhode Island:				Louisiana:			
Providence	1	0	0	Shreveport	0	1	0
New York:				Texas:			
New York	2	1	2	Galveston	0	1	0
New Jersey:				Colorado:			
Newark	1	0	0	Colorado Springs	0	0	1
Pennsylvania:				Denver	0	0	1
Philadelphia	0	0	1	Pueblo	1	0	0
Pittsburgh	1	0	1	Oregon:			
Ohio:				Portland	1	1	0
Cleveland	0	0	1	California:			
Columbus	0	1	0	Los Angeles	1	0	1
Michigan:				San Francisco	0	1	3
Detroit	0	0	1				
Iowa:							
Des Moines	0	0	1				

Encephalitis, epidemic or lethargic.—Cases: Pawtucket, 1; Indianapolis, 1; Wheeling, 1.

Pellagra.—Cases: Charleston, S. C., 3; Miami, 1; Little Rock, 1.

Typhus fever.—Cases: Atlanta, 1; Savannah, 1; Nashville, 4; Mobile, 1; Montgomery, 1; Dallas, 2.—Deaths: Nashville, 1; Mobile, 1; Dallas, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 2, 1939.—During the week ended December 2, 1939, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis	----	1	------	1	----	----	-------	-------	-------	2
[illegible]pox	12	12	8	249	457	84	40	31	81	974
[illegible]	-------	1	2	22	1	12	5	1	1	45
[illegible]	[illegible]	[illegible]	-------	2	----	----	-------	-------	-------	2
Influenza	[illegible]	[illegible]	[illegible]	-------	4	1	-------	-------	3	63
Lethargic encephalitis	-------	[illegible]	[illegible]	[illegible]	-	1	-------	-------	-------	1
Measles	-------	-------	2	[illegible]	[illegible]	15	4	5	25	479
Mumps	-------	-------	-------	59	152	8	[illegible]	[illegible]	8	227
Pneumonia	1	10	-------	----	26	1	[illegible]	[illegible]	[illegible]	[illegible]
Poliomyelitis	-------	-	-------	---	2		-------	-------	-------	2
Scarlet fever	24	9	29	121	206	18	6	38	23	474
Tuberculosis	-------	1	10	71	37	25	13	-------	-------	157
Typhoid and paratyphoid fever	-------	-------	1	10	6	1	4	1	1	24
Whooping cough	-------	37	-------	106	79	39	37	12	8	318

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases for a 6-month period appeared in the PUBLIC HEALTH REPORTS of December 29, 1939, pages 2319–2333. A cumulative table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Paauhau area.—A rat found on December 6, and one found on December 8, 1939, in Paauhau area, Hamakua District, Island of Hawaii, T. H., have been proved positive for plague.

Typhus Fever

Mexico—Tampico.—During the week ended December 9, 1939, one case of typhus fever was reported in Tampico, Mexico.

Public Health Reports

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IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

Vol. 55 • JANUARY 12, 1940 • *No. 2*

ROCKY MOUNTAIN SPOTTED FEVER

TREATMENT OF INFECTED LABORATORY ANIMALS WITH IMMUNE RABBIT SERUM

By NORMAN H. TOPPING, *Passed Assistant Surgeon, Division of Infectious Diseases, National Institute of Health, United States Public Health Service*

In a previous paper (*1*) the failure of two chemotherapeutic agents in the treatment of Rocky Mountain spotted fever in guinea pigs was reported. The present study is concerned with the investigation of the efficacy of an immune serum in the treatment of experimentally infected laboratory animals. Rabbits were used to produce the antiserum, and guinea pigs and monkeys served as the test animals.

No attempt has been made to review the literature dealing with the production of an immune serum in various animal species. One reference reporting immune horse serum prepared with guinea pig passage virus which was used in 3 infected guinea pigs following the onset of symptoms is that of Heinemann and Moore (J. Infect. Dis., **10:** 294 (1912)). In this test 1 of the 3 treated pigs survived.

PREPARATION OF IMMUNE SERUM

On August 2, 1939, four large rabbits were given intravenously 2 cc. of Rocky Mountain spotted fever vaccine. This was repeated twice weekly until a total of 8 cc. had been given. After a lapse of 8 days, each was given subcutaneously one-tenth of a freshly fed infected adult *D. andersoni* emulsified in saline.[1] The dosage of virulent tick virus was gradually increased until the rabbits were receiving one-fourth of an infected tick subcutaneously on 2 successive days each week. The same dosage was then begun intravenously. The amount was gradually increased until on November 6, 1939, the rabbits were receiving 1 whole tick intravenously on 2 successive days each week. This dosage was continued during the period that the rabbits were being bled. Fifty cc. of blood were withdrawn from each of the rabbits twice monthly. The blood was allowed to stand at room temperature overnight, and the serum was separated by centrifugation and pooled on the following morning. This raw serum, kept at 4° C., was used in most of the tests to be reported. One of the rabbits died after bleed-

[1] Supplied through the courtesy of Dr R. R Parker, Director, Rocky Mountain Laboratory, Hamilton, Mont.

ing on October 16, 1939, so that the serum used after that date was obtained from only 3 rabbits. Merthiolate (1:10,000) was added as a preservative to the serum used in the guinea-pig tests; the serum used in the treatment of the monkeys did not contain any preservative.

TREATMENT OF GUINEA PIGS

Male guinea pigs, weighing approximately 500 gm., were infected with 2 cc. of citrated whole blood of guinea pig passage virus of the Bitterroot strain of Rocky Mountain spotted fever. (This strain normally has a fatality rate of 80 to 90 percent in guinea pigs.) Groups of

DAILY TEMPERATURE RECORDS OF TREATED AND UNTREATED GUINEA PIGS

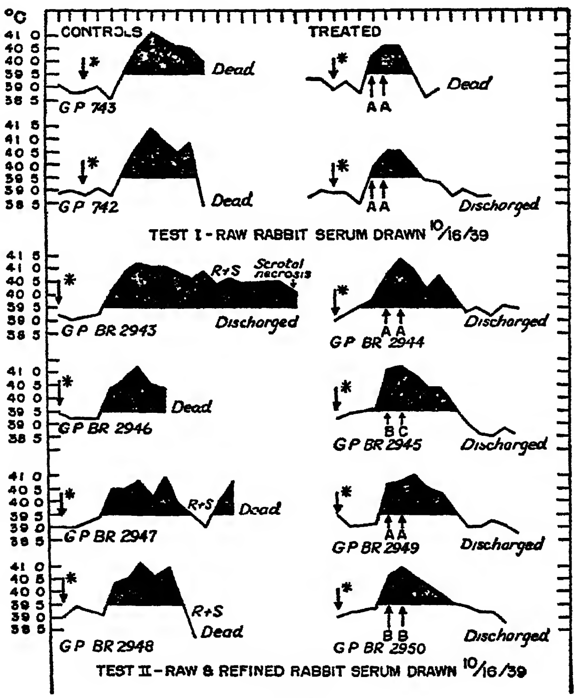


CHART 1

4 or 8 guinea pigs were infected at the same time with identical material. About one-half of these were treated on the first and second days of fever with the serum from the immunized rabbits. In tests 1, 2, and 3, the guinea pigs with the highest temperatures on that day were selected for treatment. In test 4 the even-numbered guinea pigs were treated and the odd-numbered served as controls. The dosage of serum was arbitrarily selected as 5 cc. to be given subcutaneously on the first 2 days of fever. In 3 of the treated guinea pigs (827, BR 2950, and BR 2945) an equivalent amount of serum was administered which

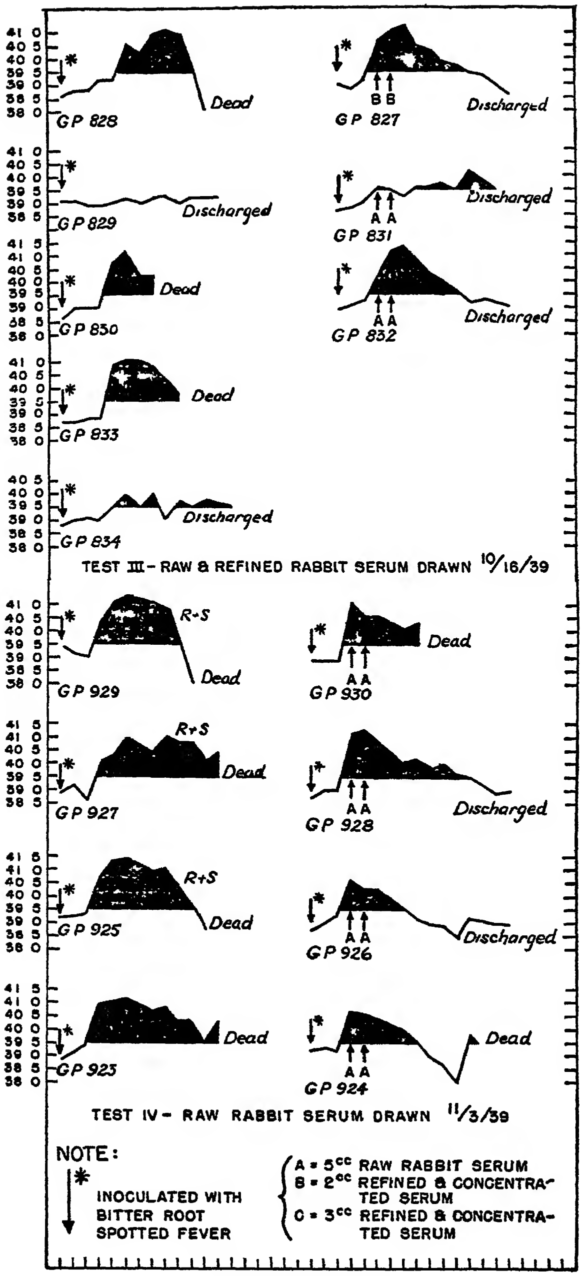


CHART 1—Continued.

had been concentrated after the method of Felton (*2*), by alcohol precipitation and centrifugation at a low temperature.

The results of these tests in guinea pigs are graphically presented in chart 1.

Deaths from all causes are included, but in at least one instance, guinea pig 924, the death was apparently due to a secondary infection. This animal was afebrile for 4 days following its attack of spotted fever, when it had another rise in temperature and died. A total of 3 of the guinea pigs (Nos. 829, 834, and 831) in test 3 failed to run typical courses of Rocky Mountain spotted fever, and apparently were not infected. The results of the guinea-pig tests are summarized in table 1.

TABLE 1.—*Results of tests in guinea pigs*

Status	Total number guinea pigs	Atypical or failure of infection	Number with typical Rocky Mountain spotted fever	Number died	Number recovered
Untreated	15	2	13	12	1
Treated	13	1	12	3	9

TREATMENT OF MONKEYS

There are two separate tests (Nos. 5 and 6) of the immune rabbit serum on infected *Macacus rhesus* monkeys. Four monkeys were used in each test. The 2 even-numbered monkeys were treated and the 2 odd-numbered served as controls. There was a male and a female in each group and each of the monkeys weighed approximately 6 pounds.

Each of the 8 monkeys was infected intraperitoneally with 1 cc. of guinea pig passage virus of the Bitterroot strain of spotted fever. On the first day of fever each of the treated monkeys received 20 cc. of raw rabbit serum intramuscularly and an additional 15 cc. was given the following day. In test 5 the 2 treated monkeys each received an additional 10 cc. on the fifth day of fever.

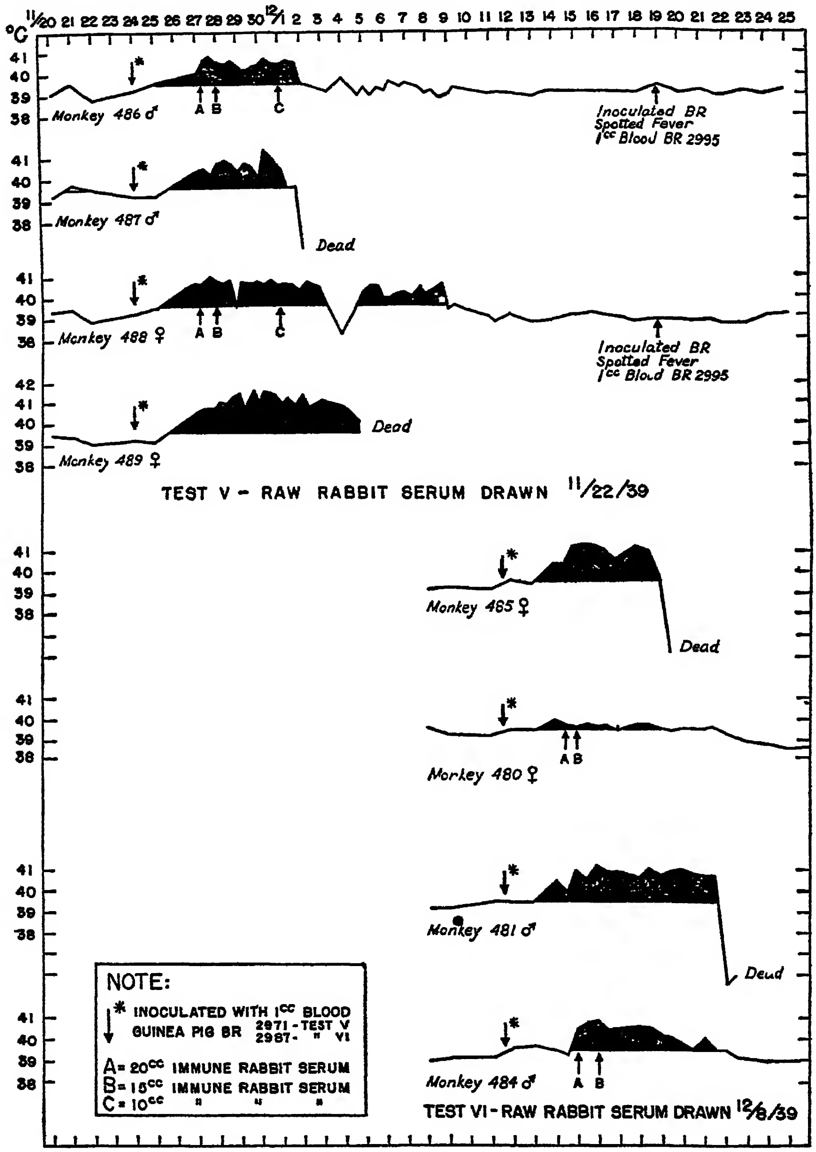
Chart 2 presents graphically the pertinent data on the two monkey tests.

All of the 8 monkeys developed the typical rash of Rocky Mountain spotted fever. In 3 of the treated monkeys, Nos. 486, 480, and 484, it was quite mild and fleeting, but in the fourth, No. 488, the rash was quite profuse. In the untreated monkeys the rash progressed rapidly and became purpuric before death.

Complete autopsies were done on the monkeys soon after death. No gross evidence of secondary infection was found. The gross pathology consisted only of an enlarged spleen and a slight injection of

the cerebral vessels. In 2 of the monkeys there was an increased pericardial fluid. Histopathological studies are being made on this

CHART 2–DAILY TEMPERATURE RECORDS OF TREATED & UNTREATED MONKEYS



material by Surgeon R. D. Lillie of the Division of Pathology of the National Institute of Health.

A summary of the two monkey tests is given in table 2.

TABLE 2.—*Results of tests in monkeys*

Test No.	Monkey No.	Status	Incubation period in days	Outcome	Total amount rabbit serum	Number of doses	Date of serum
5 (Nov 24, 1939)	487	Untreated	2	Died	None		
	489	do	2	do	do		
	486	Treated	2	Recovered	45 cc.	3	Nov. 22, 1939
	488	do	2	do	do	3	Do.
6 (Dec. 11, 1939)	481	Untreated	2	Died	None		
	485	do	2	do	do		
	480	Treated	2	Recovered	35 cc.	2	Dec. 8, 1939
	484	do	3	do	do	2	Do.

The rabbit serum drawn on December 8, 1939, was titrated for protective antibodies in guinea pigs. Briefly, the technique was as follows: Blood was drawn from an infected guinea pig on the third day of fever into a syringe containing a small amount of citrate. This material was centrifuged immediately and the clear plasma removed; 0.5 cc. of this plasma was pipetted into conical glasses containing varying amounts of the rabbit serum. Saline was used to equalize the volume. The mixtures were allowed to remain at room temperature for 30 minutes and then inoculated intraperitoneally into guinea pigs. The 4 control pigs had a 2-day incubation period and died on the seventh, ninth, eleventh, and twelfth days, respectively. The guinea pigs inoculated with the plasma virus plus 0.5 cc., 0.25 cc., 0.12 cc., 0.06 cc., 0.03 cc., and 0.015 cc. of the immune rabbit serum, respectively, all showed good protection with no deaths in the group.

SUMMARY

1. An immune serum has been produced in rabbits using tick virus of Rocky Mountain spotted fever as the antigen.

2. This rabbit serum contains a large amount of protective antibodies.

3. Data have been presented which show that this immune rabbit serum administered after the onset of symptoms prevented the death of a large majority of guinea pigs infected with Rocky Mountain spotted fever and of all the 4 monkeys tested.

REFERENCES

(*1*) Topping, Norman H.: Experimental Rocky Mountain spotted fever and endemic typhus treated with prontosil or sulfapyridine. Pub. Health Rep., **54**: 1143 (1939).

(*2*) Felton, L. D.: The use of ethyl alcohol as precipitant in the concentration of antipneumococcus serum. J. Immunol., **21**: 357 (1931).

CASES AND DAYS OF ILLNESS AMONG MALES AND FEMALES, WITH SPECIAL REFERENCE TO CONFINEMENT TO BED

Based on 9,000 Families Visited Periodically for 12 Months, 1928–31[1]

By SELWYN D. COLLINS, *Principal Statistician, United States Public Health Service*

CONTENTS

Various special surveys and other morbidity studies have assembled considerable data on illness for sample population groups. While different types of rates and averages have been used in presenting survey results, the case rate has been the favorite measure of the amount of illness. The preference for case rates as distinguished from rates based on days of sickness probably arises from the fact that the duration of an illness as reported in surveys is usually an approximation expressed frequently in round numbers such as 5, 7, or 10 days, as 1, 2, or 3 weeks, or even in months only. Moreover, the chance occurrence of exceptionally long cases renders such a rate as annual days of disability per 1,000 persons less stable than a case rate per 1,000 which gives equal weight to long and short illnesses. The fact that mortality rates are expressed as deaths (fatal cases) per 1,000 may have promoted the use of the case rate as a measure of nonfatal illness also.

Some of the various kinds of illness rates may be summarized briefly. Sickness may be measured in terms of: (*a*) The number of cases occurring within a given time per 1,000 persons, including either new cases only or new cases plus other cases that existed during but had their onset prior to the study period; furthermore, the case may be defined as including both nondisabling and disabling illness, or as including only disabling or only bed cases, or as including only cases disabling or in bed for a specified number of days, such as 7 days or longer; (*b*) the annual number of days of sickness, of days confined

[1] From the Division of Public Health Methods, National Institute of Health.

This is the fourteenth of a series of papers on sickness and medical care in this group of families (*1–13*). The survey of these families was organized and conducted by the Committee on the Costs of Medical Care; the tabulation was done under a cooperative arrangement between the Committee and the Public Health Service. Committee publications based on the results deal primarily with costs and Public Health Service publications primarily with the incidence of illness and the extent and kind of medical care, without regard to cost. As costs are meaningless without some knowledge of the extent and nature of the service received, there is inevitably some overlapping. The Committee staff, particularly Dr I. S. Falk and Miss Margaret Klem, cooperated in the tabulation of the data.

Special thanks are due to Dr. Mary Gover, who assisted in the analysis, to Mrs. Lily Vanzee Welch, who was in immediate charge of tabulating the data, to Dr. Dorothy Holland for a careful reading of the manuscript, and to other members of the statistical staff of the Public Health Service for advice and assistance in the preparation of this study.

to bed, or of days of inability to work or pursue other usual activities per person or per 1,000 persons under observation; (*c*) the days of sickness, days confined to bed, or days of inability to work or pursue other usual activities per case of illness. These last two types of rates supplement case rates and provide a different kind of measure of the extent of illness and of the importance of specific diseases as causes of illness.

The annual number of days of inability to work per 1,000 persons under observation is used extensively in sick benefit and insurance studies. In common morbidity terminology a day of inability to work or pursue other usual activities is a day of "disability," so the rate may be designated as the annual number of days of disability per 1,000 persons. This rate is computed by counting all days of disability during the year under consideration, whether the disability was associated with a case that had its onset prior to or during the period under study, or whether the case had terminated or was still sick at the close of the year. Thus, theoretically, a sample of 365 days [2] is taken from the life of each individual in the surveyed population and the number of days of disability within that period is counted. Similarly, one can compute the annual number of days confined to bed per 1,000 persons observed and the annual number of sick days, including both days of disability and days on which the person was sick but still able to pursue his usual activities.

I. SOURCE AND CHARACTER OF DATA

In the study of illness in a group of families in 18 States [3] that was made by the Committee on the Costs of Medical Care (*18*) and the United States Public Health Service, the record for each illness included three types of duration within the 12-month study period: (*a*) Total duration of symptoms (days sick), (*b*) days of inability to work or pursue other usual activities (disability), and (*c*) days confined to bed. These records of duration afford data for computing days per 1,000 population for sickness, disability, and confinement to bed, as well as days of the various kinds per case of illness.

The composition and characteristics of the group of 8,758 families which were kept under observation for 12 consecutive months in the years 1928–31 have been considered in some detail in the first report

[2] In some studies days of disability are counted as the number of work (or school) days lost on account of sickness, Sundays and holidays being left entirely out of the computation. By this method, one would count the number of work (or school) days lost out of the total possible work (or school) days during the year.

[3] The 18 States sampled and the number of canvassed families were as follows: California (890), Colorado (386), Connecticut (100), District of Columbia (99), Georgia (544), Illinois (463), Indiana (494), Kansas (301), Massachusetts (287), Michigan (329), Minnesota (224), New York (1,710), Ohio (1,148), Tennessee (212), Virginia (412), Washington (551), West Virginia (318), Wisconsin (290). Further details about the distribution of the canvassed population are included in a preceding paper (*1*).

in the series (*1*). These families, including a total of 39,185 individuals, resided in 130 localities in 18 States representing all geographic sections. Every size of community was included, from metropolitan districts to small industrial and agricultural towns and rural unincorporated areas.[4] With respect to income, the distribution was reasonably similar to the estimated distribution of the general population of the United States at the time of the survey.

Each family was visited at intervals of 2 to 4 months for a period long enough to obtain a sickness record for 12 consecutive months. On the first call a record was made of the number of members of the household, together with sex, age, marital status, occupation, and other information. On succeeding visits the canvasser recorded all illness that had occurred since the preceding call, with such pertinent facts about each case as the date of onset, the total duration of symptoms, the days of confinement to bed, and the days of disability. A record was also made of the nature of such medical service as was obtained and the termination of the case. Thus there are available certain facts about the observed population, the number of illnesses suffered, and three types of duration of the cases during the 12 months of the study.

The surveyed population of nearly 40,000 persons is sufficient to give a fair degree of reliability to the sickness rates, but the numbers of deaths in a group of this size are too few to yield reliable mortality rates for specific ages or for different diseases. In the comparison of illness and death, mortality data from the registration States have been used. That this substitution is not unreasonable is indicated in an earlier paper (*4*, figs. 1 and 3) where a comparison of mortality in the two groups is made. While the sickness data are spread over a 3-year period, most of the months of observation refer to 1929 and 1930; for this reason mortality data for the registration States for these 2 years are used.

Definition of illness as recorded in survey.—An illness, for the purpose of this study, was defined as any symptom, disorder, or affection which persisted for one or more days or for which medical service[5] was received or medicine purchased. Illness included the results of both disease and injury. What was actually included as cases, however, was necessarily influenced not only by the informant's (usually the housewife's) conception of illness but also by her memory. With visits as infrequent as 2 to 4 months, it was inevitable that many

[4] Every community that was included in the study had either a local health department or some other organization employing a visiting nurse, or both; therefore, the most rural areas with no organized community services are not represented.

[5] Exclusive of dental services, eye refractions, immunizations, and health examinations rendered when no symptoms were present.

of the nondisabling illnesses would be terminated and forgotten before the next visit of the enumerator. However, if the record includes most of the real illnesses and excludes only the minor disorders, it may be as useful as a more complete one.

No special inquiry was made about mental defectives at home or about persons away from the family throughout the year in such resident institutions as hospitals for the insane, mental defective, or tuberculous; however, a few such cases were recorded. Physical impairments such as blindness and lost and impaired limbs were not included as sickness unless the defect was treated or otherwise involved some status other than the mere presence of an impairment. These various factors made for a minimum of recorded cases that were sick or disabled throughout the year of the study. While such cases are always rare as compared with short illnesses, they have a more important influence on the total days of sickness or of disability or of time in bed during the year.

It should be emphasized that the house-to-house sickness survey of the type here reported cannot be expected to include all cases that would accumulate under a sickness study or an insurance system in which it was possible to follow cases over an unlimited period. In the first place, families existing on a given day do not include those that have been broken up by fatal illness and by insanity, tuberculosis, and other chronic diseases that call for extended hospitalization in resident institutions. In other instances the family may still exist but the patient may have been away so many years that he is no longer considered a member of the family; particularly would this be true if the patient was the grandfather, grandmother, or other person outside of what might be called the biological unit of father, mother, and children, and if hospitalization was in a State supported institution without expense to the family.[6] Moreover, sickness surveys seldom cover orphanages, infant asylums, old people's homes and similar institutions where illness and death rates are high. Since this type of institution is usually filled by persons who formerly resided in widely scattered sections of the city or State, it would be impracticable in a sample survey to know how many such institutions to include, even if it were feasible to obtain the illness data.

In terms of cases, the bias toward less illness in canvassed families than in the population as a whole does not seem to be important; but the cases missed because of institutional residence are usually chronic diseases of long duration and their effect upon the days of

[6] The 16 cases recorded in this study as hospitalized throughout the year were mostly young persons: 9 were under 15 years, 4 were 15 to 24, 1 was 35, 1 was 47, and 1 an adult of unknown age.

disability, of confinement to bed, and of confinement to a hospital is considerable.[7]

Classification of causes of illness.—In the present study of 8,758 households by periodic visits, the diagnoses as reported by family informants were submitted to the attending physician for confirmation or correction and his diagnosis substituted for the one reported by the family. While not all cases were attended and reports could not be obtained from all attending physicians, the replies indicated that the housewife usually reported with reasonable accuracy the diagnosis which the physician had given to the family.[8]

Considering an illness in the sense of a continuous period of sickness, only 4.3 percent were designated as due to more than one cause. In general, the more important or more serious cause was assigned as primary, except where a disease like pneumonia is commonly recognized as following measles or influenza, in which case the antecedent condition was taken as primary. In this series of papers, illness rates for all causes and for the broad disease groups are based on sole or primary diagnoses only, so that a day of sickness or a continuous period of sickness is never counted twice.[9] In computing the incidence of specific diseases, such as pneumonia, appendicitis, and whooping cough, all cases with the given diagnosis are counted whether it was the sole, primary, or contributory cause of the illness.

[7] Computations based on the American Medical Association report on hospitals (*21*) indicate that in 1929–30 (the approximate date of this survey) there were 2,215 days of hospital care annually per 1,000 population in the United States. Mental and nervous hospitals alone accounted for 1,205 hospital days per 1,000 population, or 54.4 percent of all days of hospital care. Tuberculosis hospitals accounted for another 159 days per 1,000, or 7.2 percent of all hospital days, leaving a total of only 851 hospital days per 1,000 population for all other types of hospitals. This latter figure may be compared with 775 hospital days per 1,000 for the 8,758 surveyed families when admissions to mental and nervous and tuberculosis hospitals are excluded. The survey total for all hospitals was 1,029 hospital days per 1,000 annually.

Considering all hospitals, including mental and nervous and tuberculosis, the American Medical Association report of 2,215 hospital days per 1,000 represents an excess of 1,186 days per 1,000 over the survey rate of 1,029 days. This excess of 1,186 days amounts to 15.5 percent of the rate of 7,667 disabled days per 1,000 population, and to 30.2 percent of the rate of 3,923 days in bed per 1,000 population as recorded by the survey. Thus the hospital care of the chronic cases largely missed by house-to-house surveys would add materially to the disabled and bed day rates. Sickness rates in terms of days per 1,000 found by surveys, therefore, pertain to persons still living in families and do not measure the total illness that has accumulated in resident institutions for chronic disease.

Annual admissions to resident institutions for mental and tuberculous diseases are not numerically important; the annual admissions were only 1.36 and 0.75 per 1,000 population, respectively, or 2.4 and 1.3 percent of the total hospital admission rate of 57.8 per 1,000. (These data are for 1932, the first year that the American Medical Association report showed admissions to mental and nervous hospitals.) Therefore, the missing of these chronic hospitalized cases has little effect upon case rates per 1,000 for total, disabling, bed, or even hospital cases.

[8] See comparison of diagnoses reported by families and by physicians in the National Health Survey of 1935–36 (*25*, table 2).

[9] Further details on the method of classifying the causes of illness are included in the first report in the series (*1*). As noted in that paper, an occasional minor nondisabling case that lasted throughout the study year was coded as an independent case of sole or primary diagnosis even though an acute case occurred within the duration of the long case. In computing the total days of sickness (disabling and nondisabling) a correction was made for such overlapping durations.

Methods of computation.—In computing case rates per 1,000 population, illnesses that originated prior to but caused sickness during the study year are included with cases having their onset within the period of observation; the inclusion of the illnesses with prior onset seemed necessary to give proper representation to chronic ailments. The only date of onset available was the onset of symptoms (nondisabling or disabling). Therefore, prior onset for disabling or bed cases does not necessarily mean prior onset of inability to work or of confinement to bed. Seven percent of the attacks of illness had their onset prior to the year; this does not mean that in the other 93 percent the disease always had its onset within the year, for the patient may have had preceding attacks of the same chronic disease. For all diagnoses commonly considered as chronic, 33 percent were reported with an onset for this illness prior to the study year, as compared with 3 percent for diagnoses ordinarily considered acute. A large proportion of the cases of such diseases as tuberculosis, cancer, diabetes, and cardio-renal affections originated prior to the study; a preceding paper shows for each diagnosis the number of illnesses with prior onset (*1*).

The days of duration refer in all instances to days *within the 12-month study period;* thus the maximum duration of any type is 365 days. In computing average days sick, disabled, or in bed per case, both complete and incomplete cases are included as cases but the days refer to those within the study year only. The incomplete cases (those with prior onset and those still sick at the last report) usually average considerably longer durations than the complete cases and an average which excluded them from the computation would be biased toward the shorter cases. Computation of the annual days sick, disabled, or in bed per 1,000 persons observed includes all days within the study year, whether those days pertain to cases that originated within or prior to the year and whether they pertain to cases that had been terminated or were still sick at the end of the period of observation. Bed cases with an unknown number of days in bed are put in at the average bed days for bed cases of the same diagnosis; disability and total duration are handled in a similar way. In a few instances it was unknown whether the patient was confined to bed and such cases were counted as not in bed; similarly, cases in which it was unknown whether the patient was disabled were counted as not disabled.

II. EXTENT OF ILLNESS AS MEASURED BY VARIOUS TYPES OF RATES

Frequency rates for the various kinds of cases (total, disabling, and bed) have been presented in preceding papers in this series (*1*, *4*, *5*, *6*), but it may be worth while to summarize them here, along with rates for days of sickness, of disability, and of confinement to bed.

TABLE 1.—*Age and sex incidence of illness from all causes*[1] *as measured by various types of rates—sickness among 8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31; deaths among the white population of the registration States, 1929–30*

Sex and type of rate	All ages[2] Adjusted[3]	All ages[2] Crude	Age: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
All illnesses (disabling and nondisabling):												
Cases per 1,000 population:												
Both sexes, all causes	823	850	1,211	978	679	600	672	820	774	760	845	979
Male, all causes	720	772	1,240	1,000	684	562	454	610	617	625	723	851
Female, all causes	915	925	1,187	957	674	638	832	976	932	925	991	1,078
Female, all except genital and puerperal	833	846	1,185	955	668	589	625	750	806	877	978	1,070
Days sick per 1,000 population:												
Both sexes, all causes	29,403	26,295	21,406	18,437	16,343	16,472	20,571	27,550	30,118	38,297	53,012	73,968
Male, all causes	23,217	21,383	21,589	18,329	14,969	15,114	12,405	17,814	21,062	29,241	42,725	61,336
Female, all causes	35,241	31,038	21,281	18,542	17,737	17,833	26,531	34,773	39,259	49,302	65,375	83,807
Female, all except genital and puerperal	31,679	27,704	21,250	18,520	17,475	16,714	20,645	26,338	32,781	44,669	63,571	82,663
Days sick per case:												
Both sexes, all causes	35.7	30.9	17.7	18.9	24.1	27.5	30.6	33.6	38.9	50.4	62.8	75.6
Male, all causes	32.2	27.7	17.4	18.3	21.9	26.9	27.8	29.2	34.2	46.7	59.1	72.1
Female, all causes	38.5	33.6	17.9	19.4	26.3	28.0	31.9	35.6	42.1	53.4	66.0	77.7
Female, all except genital and puerperal	38.0	32.7	17.9	19.4	26.1	28.4	33.0	35.1	40.7	50.9	65.0	77.3
Nondisabling illness:												
Cases per 1,000 population:												
Both sexes, all causes	331	334	547	253	198	228	242	332	347	367	419	430
Male, all causes	285	300	562	268	206	225	162	252	264	282	335	375
Female, all causes	374	367	536	239	190	230	301	391	430	469	520	472
Female, all except genital and puerperal	359	351	535	237	187	215	276	355	401	451	515	471
Days per 1,000 population:												
Both sexes, all causes	21,736	18,933	14,150	9,714	10,146	11,691	14,187	20,122	23,482	31,622	43,791	55,378
Male, all causes	16,110	14,448	14,072	9,407	8,977	10,250	8,071	11,814	15,265	23,169	32,872	43,714
Female, all causes	27,123	23,261	14,271	10,012	11,332	13,135	18,651	26,285	31,776	41,977	56,913	64,463
Female, all except genital and puerperal	24,690	21,014	14,250	9,990	11,092	12,397	15,572	21,036	27,232	37,875	55,256	63,435
Disabling[4] illness (1 or more days):												
Cases per 1,000 population:												
Both sexes, all causes	492	516	664	725	481	372	430	488	427	393	426	549
Male, all causes	435	472	678	732	478	337	292	358	353	343	388	476
Female, all causes	541	558	651	718	484	408	531	585	502	456	471	606
Female, all except genital and puerperal	474	495	650	718	481	374	349	395	405	426	463	599

[1] Cases represent periods of illness regardless of the number of diagnoses; that is, these totals for all causes are the sums of data for cases with sole or primary diagnoses. Cases refer to those that lasted for 1 or more days, including those with prior onset that extended into the study year and those still sick at the last visit; days refer to duration within the study year only but on both complete and incomplete cases. In computing durations, cases with an unknown number of days of the particular kind of duration were put in at an average based on cases of the same diagnosis group with known duration, exclusive of the few cases that lasted throughout the year of observation. Illness from accident is included along with that due to disease.

[2] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

[3] Rates in the form of cases or days per 1,000 population are adjusted by the direct method to the age distribution of the white population of the death registration States in 1930 as a standard population; this population is given for specific ages in table 1 of a preceding paper (*4*). The adjustment method involves the weighting of the age specific rates for the canvassed population according to the age distribution of the standard population. The details of the process are given under the heading of "corrected death rates" in Pearl (*23*), pp. 269–271.

Figures in the "adjusted" column on days per case represent the result of dividing the adjusted rate for days per 1,000 by the adjusted rate for cases per 1,000; figures in the "adjusted" column for percentage of cases or percentage of days represent the percentage that one adjusted rate per 1,000 is of another adjusted rate per 1,000.

[4] Disability refers to inability to work, attend school, care for home, or pursue other usual activities for 1 or more days, regardless of employment status and age.

TABLE 1.—*Age and sex incidence of illness from all causes as measured by various types of rates—sickness among 8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31; deaths among the white population of the registration States, 1929–30*—Continued

Sex and type of rate	All ages: Adjusted	All ages: Crude	Age: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
Disabling illness (1 or more days):—Con.												
Days disabled per 1,000 population:												
Both sexes, all causes	7, 667	7, 362	7, 256	8, 723	6, 197	4, 781	6, 384	7, 428	6, 636	6, 675	9, 221	18, 590
Male, all causes	7, 107	6, 935	7, 517	8, 922	5, 992	4, 864	4, 334	6, 000	5, 797	6, 072	9, 853	17, 622
Female, all causes	8, 118	7, 777	7, 010	8, 530	6, 405	4, 698	7, 880	8, 488	7, 483	7, 415	8, 462	19, 344
Female, all except genital and puerperal	6, 989	6, 690	7, 000	8, 530	6, 383	4, 317	5, 073	5, 297	5, 549	6, 794	8, 315	19, 228
Percent of cases disabled:												
Both sexes, all causes	59. 8	60. 7	54. 8	74. 1	70. 9	62. 1	64. 0	59. 5	55. 2	51. 7	50. 4	56. 1
Male, all causes	60. 4	61. 2	54. 7	73. 2	69. 9	59. 9	64. 3	58. 7	57. 3	54. 8	53. 7	55. 9
Female, all causes	59. 1	60. 3	54. 8	75. 1	71. 9	63. 9	63. 9	59. 9	53. 9	49. 2	47. 5	56. 2
Female, all except genital and puerperal	56. 9	58. 5	54. 8	75. 2	71. 9	63. 4	55. 9	52. 7	50. 2	48. 6	47. 4	56. 0
Percent of sick days that were disabled days:												
Both sexes, all causes	26. 1	28. 0	33. 9	47. 3	37. 9	29. 0	31. 0	27. 0	22. 0	17. 4	17. 4	25. 1
Male, all causes	30. 6	32. 4	34. 8	48. 7	40. 0	32. 2	34. 9	33. 7	27. 5	20. 8	23. 1	28. 7
Female, all causes	23. 0	25. 1	32. 9	46. 0	36. 1	26. 8	29. 7	24. 4	19. 1	15. 0	12. 9	23. 1
Female, all except genital and puerperal	22. 1	24. 1	32. 9	46. 1	36. 5	25. 8	24. 6	20. 1	16. 9	15. 2	13. 1	23. 8
Disabled days per disabling case:												
Both sexes, all causes	15. 6	14. 3	10. 9	12. 0	12. 9	12. 8	14. 8	15. 2	15. 5	17. 0	21. 7	33. 9
Male, all causes	16. 3	14. 7	11. 1	12. 2	12. 5	14. 5	14. 9	16. 8	16. 4	17. 7	25. 4	37. 0
Female, all causes	15. 0	13. 9	10. 8	11. 9	13. 2	11. 5	14. 8	14. 5	14. 9	16. 3	18. 0	31. 9
Female, all except genital and puerperal	14. 7	13. 5	10. 8	11. 9	13. 3	11. 6	14. 5	13. 4	13. 7	15. 9	17. 9	32. 1
Bed illness (1 or more days):												
Cases per 1,000 population:												
Both sexes, all causes	414	434	609	562	372	288	373	431	368	334	342	497
Male, all causes	345	379	620	567	364	248	220	279	275	268	289	398
Female, all causes	476	457	598	558	381	328	485	545	462	414	407	574
Female, all except genital and puerperal	411	425	598	558	378	290	307	357	367	386	399	567
Days in bed per 1,000 population:												
Both sexes, all causes	3, 923	3, 689	3, 862	3, 405	3, 000	2, 516	3, 257	3, 960	3, 470	3, 580	4, 424	10, 759
Male, all causes	3, 046	3, 024	4, 087	3, 442	2, 770	2, 460	1, 510	2, 425	2, 296	2, 511	3, 585	8, 263
Female, all causes	4, 699	4, 321	3, 566	3, 370	3, 233	2, 572	4, 531	5, 099	4, 654	4, 891	5, 432	12, 702
Female, all except genital and puerperal	3, 943	3, 593	3, 562	3, 370	3, 228	2, 320	2, 607	2, 819	3, 467	4, 568	5, 302	12, 620
Percent of cases in bed:												
Both sexes, all causes	50. 4	51. 1	50. 3	57. 5	54. 8	48. 0	55. 5	52. 6	47. 6	43. 9	40. 5	50. 8
Male, all causes	47. 9	49. 1	50. 0	56. 7	53. 2	44. 2	48. 5	45. 6	44. 6	42. 9	39. 9	46. 8
Female, all causes	52. 0	52. 7	50. 4	58. 3	56. 5	51. 4	58. 3	55. 8	49. 6	44. 8	41. 0	53. 2
Female, all except genital and puerperal	49. 3	50. 2	50. 5	58. 4	56. 5	50. 3	49. 1	47. 6	45. 5	44. 1	40. 8	53. 0
Percent of sick days that were bed days:												
Both sexes, all causes	13. 3	14. 0	18. 0	18. 5	18. 4	15. 3	15. 8	14. 4	11. 5	9. 3	8. 3	14. 5
Male, all causes	13. 1	14. 1	18. 9	18. 8	18. 5	16. 3	12. 2	13. 6	10. 9	8. 6	8. 4	13. 5
Female, all causes	13. 3	13. 9	16. 8	18. 2	18. 2	14. 4	17. 1	14. 7	11. 9	9. 9	8. 3	15. 2
Female, all except genital and puerperal	12. 4	13. 0	16. 8	18. 2	18. 5	13. 9	12. 6	10. 7	10. 6	10. 2	8. 8	15. 3
Percent of disabling cases that were in bed:												
Both sexes, all causes	84. 3	84. 1	91. 7	77. 6	77. 4	77. 4	86. 7	88. 4	86. 2	84. 9	80. 4	90. 5
Male, all causes	79. 3	80. 2	91. 4	77. 5	76. 2	73. 7	75. 5	77. 8	77. 9	78. 3	74. 4	83. 7
Female, all causes	88. 0	87. 3	91. 9	77. 7	78. 6	80. 3	91. 2	93. 2	92. 0	91. 0	86. 3	94. 7
Female, all except genital and puerperal	86. 6	85. 9	92. 0	77. 7	78. 5	79. 3	87. 9	90. 2	90. 6	90. 7	86. 1	94. 6

TABLE 1.—*Age and sex incidence of illness from all causes as measured by various types of rates—sickness among 8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31; deaths among the white population of the registration States, 1929–30*—Continued

Sex and type of rate	All ages		Age									
	Adjusted	Crude	Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
Bed illness (1 or more days):—Continued.												
Percent of disabled days that were bed days:												
Both sexes, all causes	51.2	50.1	53.2	39.0	48.4	52.6	51.0	53.3	52.3	53.6	48.0	57.9
Male, all causes	42.9	43.6	54.4	38.6	46.2	50.6	34.8	40.4	39.6	41.3	36.4	46.9
Female, all causes	57.9	55.6	50.9	39.5	50.5	54.7	57.5	60.1	62.3	66.0	64.2	65.7
Female, all except genital and puerperal	56.4	53.7	50.9	39.5	50.6	53.8	51.4	53.2	62.5	67.2	63.8	65.7
Days in bed per bed case:												
Both sexes, all causes	9.5	8.5	6.3	6.1	8.1	8.7	8.7	9.2	9.4	10.7	12.9	21.6
Male, all causes	8.8	8.0	6.6	6.1	7.6	9.9	6.9	8.7	8.3	9.4	12.4	20.7
Female, all causes	9.9	8.9	6.0	6.0	8.5	7.8	9.3	9.4	10.1	11.8	13.4	22.1
Female, all except genital and puerperal	9.6	8.5	6.0	6.0	8.5	7.8	8.5	7.9	9.5	11.8	-3.3	22.3
Mortality:												
Deaths per 1,000 population:												
Both sexes, all causes	11.07	11.07	17.11	1.92	1.46	2.41	3.37	4.03	6.08	11.04	23.08	75.10
Male, all causes	11.98	11.99	18.91	2.12	1.67	2.66	3.55	4.23	6.75	12.50	25.78	78.40
Female, all causes	10.12	10.13	15.25	1.71	1.25	2.17	3.20	3.83	5.36	9.47	20.21	71.81
Female, all except genital and puerperal	9.80	9.80	15.25	1.71	1.25	1.90	[illegible].61	3.08	4.70	.22	20.09	71.63
Number of illnesses per death:												
Both sexes, all causes	74.3	76.7	70.8	510.7	464.3	248.3	199.3	203.7	127.3	68.8	36.6	13.0
Male, all causes	60.1	64.4	65.6	472.4	410.3	211.1	128.0	144.3	91.3	50.1	28.0	10.9
Female, all causes	90.4	91.3	77.9	560.2	537.9	294.2	259.6	255.0	173.9	97.7	49.0	15.0
Female, all except genital and puerperal	85.0	86.3	77.7	559.5	536.0	309.5	239.7	243.4	171.5	95.2	48.7	14.9
Number of bed cases per death:												
Both sexes, all causes	37.4	39.2	35.6	293.6	254.6	119.2	110.6	107.1	60.6	30.2	14.8	6.6
Male, all causes	28.8	31.6	32.8	267.9	218.4	93.3	62.1	65.9	40.8	21.5	11.2	5.1
Female, all causes	47.0	48.1	39.2	326.6	303.8	151.2	151.3	142.4	86.2	43.8	20.1	8.0
Female, except genital and puerperal	41.9	43.4	39.2	326.7	302.9	155.6	117.7	115.7	78.0	41.9	19.9	7.9
Population (years of life):												
Both sexes	------	38,544	5,513	5,715	4,568	3,050	2,119	5,640	5,930	3,351	1,473	998
Male	------	18,896	2,808	2,820	2,301	1,527	894	2,402	2,979	1,845	804	437
Female	------	19,627	2,684	2,895	2,267	1,523	1,225	3,238	2,951	1,506	669	561

Adjusted [10] *rates for all ages.*—In these 8,758 families visited at intervals of 2 to 4 months in urban and rural parts of 18 States, an annual total of 823 illnesses from all causes per 1,000 population was reported; the average duration of symptoms, including both nondisabled and disabled days, during the 12-month study period was 36 sick days per case, with an annual total of 29 days of sickness per person

[10] The rates quoted for the surveyed population throughout this discussion have been adjusted to the age distribution of the white population of the United States in 1930. In other words, the rates are corrected for the fact that the surveyed sample did not have the same age distribution as the general population of the United States. Percentages of cases and of days quoted in the text are computed from adjusted rates rather than from the actual numbers of cases; similarly, days per case are computed from the adjusted rates. In no cases are these measures radically different from similar computations based on the actual numbers of cases; both results are shown in table 1. These age adjustments and minor corrections in the tabulations account for discrepancies between rates and percentages here quoted and some rates and percentages appearing in preceding papers.

under observation.[11] Of the total illnesses, 492 per 1,000 persons were disabling, that is, they caused the patient to lose one or more days during the study year from work, school, or other usual activities. The average duration of disability during the study year per disabling case was 15.6 days, with an annual total of 7.7 days of disability per person under observation.[12] Thus 60 percent of the reported cases of illness were disabling for 1 day or longer, but only 26 percent of the sick days were disabled days.

Of the disabling cases, 84 percent were confined to bed for one or more days, an annual rate of 414 bed cases per 1,000 persons, leaving almost the same number, 409 cases per 1,000, with no days in bed.

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[11] These figures for total duration of symptoms are, in the nature of the data, only approximate because the criterion for sickness is not definite. As tabulated in this study, sickness would not include the mere presence of a physical impairment that did not represent an active disease process and did not receive medical treatment during the year, but it would include chronic or other diseases that were still active even when the present symptoms were minor.

The approximate character of the rate for total days sick (nondisabling and disabling) is illustrated by the following facts: Of the 29.4 days sick per person observed per year, 56 percent, or 16.4 days per person observed, are accounted for by the few cases that were sick throughout practically the whole study year (45 cases per 1,000, or 5 percent of the total of 823 cases per 1,000). No intensive effort was made to elicit information about every minor chronic affection present at the beginning of the study; if each family had been asked particularly about mild nondisabling chronic diseases, the reported days of nondisabling illness from such continuing ailments would probably have been greatly increased. One study indicates about 2 months of such sickness (nondisabling and disabling) instead of the 1 month indicated in the present report.

[12] The annual disability rate of 7.7 days per person of all ages and all employment statuses is considered a minimum if not an understatement of the days of actual inability to pursue usual activities. Certain biases may be mentioned: (a) For housewives and others not gainfully employed there seemed to be a tendency to record disability only when the patient was confined to bed; thus adult females show little disability in excess of time in bed, whereas adult males show a considerable excess. (b) There seemed to be a tendency to count the school child as disabled only on school days; thus illness during week ends and vacation was less likely to be recorded as disabling. (c) For at least short cases the standard of calendar days disabled was not always adhered to and thus illness of gainfully employed workers on Sundays and holidays was less likely to be recorded as disabling. Durations of longer illnesses were usually stated in numbers that indicated that 7-day weeks and 30-day months were consistently used.

In this study of 8,758 families, physical impairments such as blindness and lost and impaired limbs and minor mental defect without symptoms were not included as sickness unless the defect was treated or otherwise involved some status other than the mere presence of an impairment. The National Health Survey of 1935–36 which included disability from blindness and orthopedic impairments and inquired about children of school ages who were not attending school as possible cases of mental defect, recorded nearly 7 times as many illnesses as the present study in which the patient was disabled throughout the year but was not in bed or in a hospital. However, both rates were small, 5.21 per 1,000 for the Health Survey and 0.78 for this study. Such cases would often be due to blindness, orthopedic impairment, or mental defect not serious enough to require hospitalization.

In these periodic canvasses of 8,758 families the recorded cases that were disabling for 7 days but less than 12 months (including also hospital cases disabling 1 to 6 days) were responsible during the year for 5.8 days of disability per person observed, as compared with a finding of 5.6 days per person for cases of similar duration in the Health Survey of 1935–36 which covered about 700,000 urban families by a single visit (*24*). However, these rates probably overstate the agreement between the two surveys, since the periodic surveys recorded 267 such cases per 1,000 with an average duration of 21.8 disabled days per case, as compared with 160 for the Health Survey with an average duration of 35.1 disabled days per case. Time in bed in connection with cases that disabled for 7 days but less than 12 months (including also hospital cases disabling 1 to 6 days) amounted during the year to 3.0 days per person observed in the periodic canvasses as compared with 2.5 days in the Health Survey of 1935–36. The time in bed per disabling case of this category was 11.1 days in the periodic canvass study as compared with 15.7 days in the Health Survey. The above figures on bed cases and days for the Health Survey are based on a 5 percent sample of the punch cards for cases of illness.

In the periodic canvasses where little or no disability from impairments or institutionalized cases was recorded, illnesses with disability that lasted throughout practically the whole study year amounted to 3.1 cases per 1,000, as compared with 11.7 for the Health Survey; days of disability on these cases amounted during the year to 1.14 days per person observed in the periodic convasses, as compared with 4.22 in the Health Survey of 1935–36.

About one-fifth of the cases that were not in bed reported disability for one or more days, 78 per 1,000 persons observed. The average time in bed during the study year per bed case was 9.5 days, with an annual total of 3.9 days in bed per person under observation.[13] Of the total cases, 50 percent were in bed for one or more days, but of the total days of sickness, only 13 percent were days in bed. Of the total disabling cases 84 percent were in bed for one or more days, but only 51 percent of the days of disability were spent in bed.

Among white persons in the registration States at the time of the survey (1929–30), there was an annual death rate of 11.1 per 1,000 population; in the surveyed families the death rate (adjusted for age) was 9.6 per 1,000 persons observed.[14] Infant mortality, which is expressed as deaths under 1 year of age per 1,000 live births, was 61 for white infants in the birth registration States, 1929–30; in the surveyed families the figure was 53 per 1,000 live births.[15] The canvassed group included only families and would not include representation from such institutions as orphanages, resident hospitals for the insane, almshouses, and homes for the aged where death rates are usually high.

Relating the death rate of 11.1 per 1,000 to the sickness rate, it may be estimated that about 74 illnesses occur during the year for each death. Similarly, relating the death rate to disabling and bed cases, it appears that there are about 44 disabling illnesses and about 37 bed cases during the year for each death.

Age and sex differences in various types of rates.—The variation with age and sex in the different types of sickness rates may be examined. Figure 1 shows age curves of illness from all causes as expressed in the different kinds of rates. Separate curves are shown for males and females for all causes, with a third curve for illness among females exclusive of puerperal diagnoses and diseases of the female genital

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[13] In these periodic canvasses of 8,758 families the recorded cases that were in bed for 7 days but less than 12 months were responsible during the year for 2.7 days in bed per person observed, as compared with 2.8 for cases of similar durations recorded in the Health Survey of 1935–36. However, the periodic surveys recorded 141 such bed cases per 1,000 persons with an average duration of 18.9 bed days per case, as compared with 106 per 1,000 for the Health Survey with an average duration of 26.9 bed days per case.

The Health Survey shows a smaller number of bed days in connection with cases disabling 7 days but less than 12 months (2.5 bed days per person observed) than for cases in bed 7 days but less than 12 months (2.8 bed days per person observed); this situation is due to a high average number of days in bed for the considerable number of cases that were disabling throughout the 12 months of the study but were not in bed throughout that period.

In the periodic canvasses, cases confined to bed (or hospital) throughout practically the whole study year amounted to 1.16 per 1,000, as compared with 1.69 per 1,000 in the Health Survey; days in bed (or in hospital) on these cases amounted during the year to 0.42 per person observed in the periodic canvasses, as compared with 0.62 for the Health Survey of 1935–36.

The above figures on bed cases and days for the Health Survey are based on a 5-percent sample of the punchcards for cases of illness.

[14] The death rate in the surveyed group is based on families observed for a full 12-month period and those observed for less than that time. For further details and comparisons with deaths in the registration States, see p. 67 of this paper and table 1 and figures 1 and 3 of a preceding paper (4).

[15] Corresponding rates for 1937, the latest available year, were 10.9 deaths per 1,000 white population of all ages, and 50 infant deaths per 1,000 white live births.

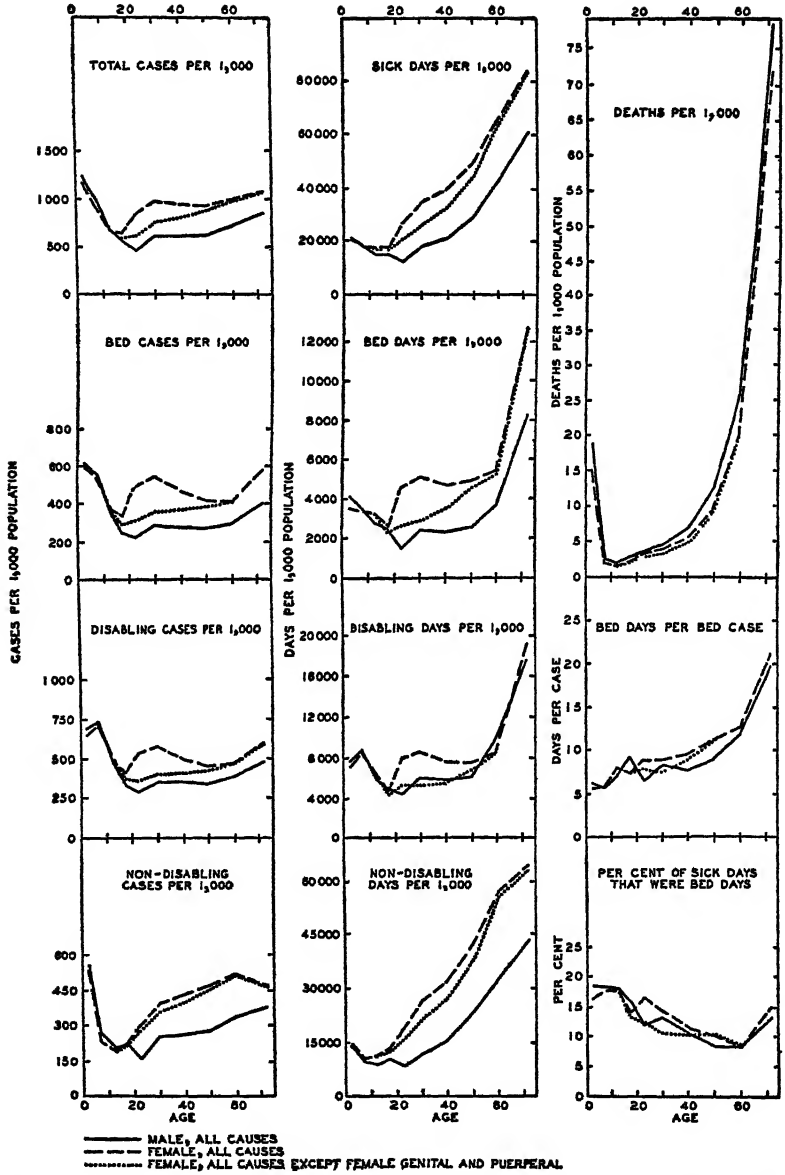

FIGURE 1.—Annual incidence of illness from all causes as measured by various types of rates for males and females of specific ages—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31. (Scales are so made that the adjusted rate for all ages of both sexes represents an interval on the vertical rate scale that corresponds to 30 years on the horizontal age scale.)

organs. Nonvenereal diseases of the male genital organs are such a small part of the total illness of males that their exclusion would not change the curves for all causes in any material respect.

Considering illness among children, the rates for total cases and sick days and for bed cases and bed days are highest for those under 5 years with a gradual decline to a minimum at 15–19 for females and at 20–24 years for males. The lower rates under 5 than at 5–9 years for disabling cases and days is probably an artifact arising from inability to determine when such a child is not pursuing his usual activities unless he is actually confined to bed; in infancy even the criterion of confinement to bed is almost inapplicable.

Considering incidence among adults, the frequency of cases rises relatively little in the older ages. However, the annual days of sickness and of disability and the days in bed per 1,000 persons under observation all increase considerably in the older ages among both men and women, because of an increasing duration of the cases as age increases. Since this chart is based on illness from all causes, the increase is probably due to two factors: (*a*) The diseases that are most frequent in the older ages are not the same as those that are common in the earlier ages, so that the average duration of cases among persons over 65 years of age refers largely to diagnoses different from those in the younger ages; (*b*) for cases of the same diagnosis the severity, as reflected in the duration per case, tends to increase with age among adults.

The age curves of mortality from all causes differ in several major respects from all of the illness curves: (*a*) The lowest mortality occurs at 10–14 years for both males and females, whereas the lowest illness rates occur at 15–19 and 20–24 for females and males, respectively. (*b*) As age increases among adults the mortality rate rises much more rapidly than any of the various sickness rates. Thus, the illness rates which show the greatest increase with age (total sick days and nondisabled days) are 2 to 3 times as high at 55–64 as at 25–34 years, but mortality at 55–64 is 5 to 7 times that at 25–34 years. Among persons over 65 years of age these sickness rates are 2 to 4 times the rates at 25–34 years, but mortality is roughly 20 times that at 25–34 years. (*c*) In every age group the mortality of females is less than that of males, whereas adult females report definitely more illness than adult males, according to all of the measures of illness except days of disability per 1,000. It is possible that there was a tendency to count nonworking females as disabled only when confined to bed, so that this rate for females is artificially low.

The various age curves of illness usually show little or no difference between the sexes in childhood. Among adults above 20 years there are rather large sex differences which are not all accounted for by illness reported as due to female genital and puerperal causes. Considering all illness (disabling and nondisabling) in the whole surveyed population, the adjusted rate for males is 720 cases per 1,000 as compared with rates for females of 915 for all causes and 833 per 1,000

for all except female genital and puerperal diagnoses; thus the excess of females over males is 16 percent for diagnoses that are common to the two sexes. Similar figures for annual days of sickness per person observed are 23.2 days for males as compared with rates for females of 35.2 days per person for all causes and 31.7 for all except female genital and puerperal diagnoses, an excess of females over males of 36 percent for diagnoses common to the two sexes. This larger excess in days than in cases expresses itself in the days sick per case, 32.2 for males as compared with figures for females of 38.5 days for all causes and 38.0 days per case for all except female genital and puerperal diagnoses (table 6).

The higher sickness rates for females than for males is rather largely due to an excess of nondisabling illness. Nondisabling cases amounted to 285 per 1,000 for males as compared with rates for females of 374 for all causes and 359 cases per 1,000 for all except female genital and puerperal diagnoses, an excess of 26 percent for comparable diagnoses. Disabling cases, on the other hand, amount to 435 cases per 1,000 for males as compared with rates for females of 541 for all causes and 474 for all except female genital and puerperal diagnoses, an excess of only 9 percent for comparable diagnoses. In terms of days of sickness the contrast of disabling and nondisabling illness is even more striking, the nondisabled days per 1,000 for females for all except female genital and puerperal diagnoses being 53 percent above the corresponding rate for males, whereas the recorded rate for disabled days per person observed is actually 2 percent less for females than for males when female genital and puerperal diagnoses are eliminated; however the total rate for all causes for females is considerably above that for males.

Illness that confined the patient to bed for one or more days amounted to 345 cases per 1,000 total surveyed males as compared with rates among females of 476 for all causes and 411 for all except female genital and puerperal diagnoses, an excess of 19 percent for females for diagnoses common to the two sexes. In terms of days in bed, males showed an annual rate of 3.0 days per person observed as compared with rates for females of 4.7 days for all causes and 3.9 days for all except female genital and puerperal diagnoses, an excess of 29 percent for comparable diagnoses. Thus the percentage excess of bed illness among females over that among males is not only greater than corresponding excesses for disabling illness but it is greater than for all types of cases. The conclusion seems justified, therefore, that women spend more time as bed patients than do men; it is not clear, however, whether this indicates more frequent illness among females, a greater severity of illness, or better care of the illness that occurs.

The above comparisons of rates for all males and females in the surveyed population are subject to error because a large proportion

of females are housewives or others not employed away from home. The relatively small excess of disabling illness for females over that for males may be due in part to the fact that for persons not gainfully employed there is no definite criterion of inability to work except actual confinement to bed. The housewife may carry on her work on a more or less part-time basis, postponing all except the most essential tasks, and yet be counted as not disabled. However, the excess in recorded cases and days of nondisabling sickness for females over males probably reflects also a more complete reporting of minor illnesses for the family informant [16] who was usually a woman.

With respect to bed illness, the housewife, who was usually the informant, would seem well qualified to give a complete report for all members of the family. Days in bed, aside from those in a hospital, would be spent at home and usually under the more or less direct care of the housewife informant. However, women or other persons not working away from home can usually remain in bed with less disturbance to the day's schedule than a person who works away from home. Where there are two adults or grown children who do not work or go to school, or where there are servants, the housewife may direct the housework from her sickbed, whereas the work of one who is employed away from home must cease and even that of his associates may suffer because of his absence.

Because of the difficulty of determining when a nonworking person was unable to pursue his usual activities, the days of disability as recorded in this study probably represent a minimum or understatement. Disability becomes an objective measure of illness only when applied to persons who are gainfully employed and even then the frequency with which persons remain away from work on account of illness is influenced by the allowance of sick leave [17] and other policies of employers (*16*, p. 340). To avoid some of these biases in sickness rates of males and females, a tabulation was made for persons who gave an occupation which indicated employment away from home. Figure 2 and table 2 show rates of various types for these presumably gainfully occupied men and women of various ages.

Since the most comparable rates are those for illness exclusive of male and female genital and puerperal diagnoses [18] these rates are

[16] In the Hagerstown morbidity study (*27*), Sydenstricker made a special tabulation of households with two or more adult females to compare sickness rates for women who were reporting upon themselves with those for women who were reported upon by others, as well as for males who were almost invariably reported upon by someone else. The tabulation indicated higher recorded sickness rates for female informants than noninformants, but rates for female noninformants were considerably higher than rates for males.

[17] While no information about sick leave was obtained in this study, it may be assumed that the majority of the workers lost their wages when they were disabled.

[18] Neither female genital and puerperal nor male genital diseases are numerically important among employed persons, but for accurate comparison all these diagnoses are eliminated. Accidents are included along with illness from other causes, but they are much more frequent among males than females; however, the general picture of illness among males and females is not changed when accidents are eliminated.

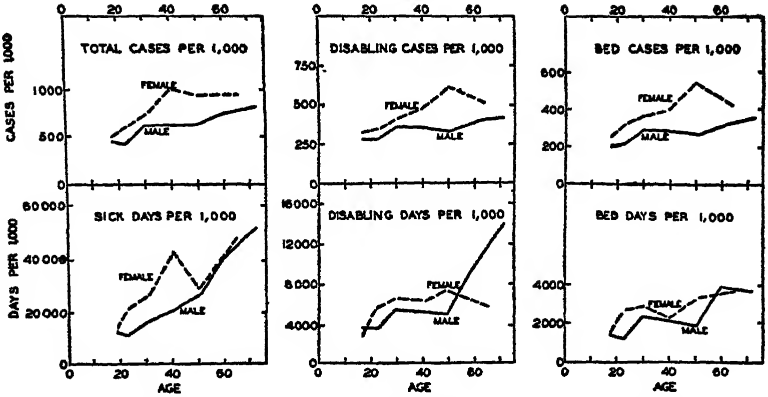

FIGURE 2.—Annual incidence of illness as measured by various types of rates for all causes except genital and puerperal diagnoses among gainfully employed males and females of specific ages—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31. (Scales are so made that the adjusted rate for all ages of both sexes, nonoccupied and occupied, represents an interval on the vertical rate scale that corresponds to 30 years on the horizontal age scale.)

TABLE 2.—*Age and sex incidence of illness from all causes* [1] *as measured by various types of rates for gainfully occupied persons* [2] *in 8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

Sex and type of rate	All ages 15 years and over: Number of cases or days	All ages 15 years and over: Adjusted [3]	All ages 15 years and over: Crude	Age [5]: 15–19	20–24	25–34	35–44	45–54	55–64	65 and over
	All causes									
All illness:										
Cases per 1,000 population:										
Males	4,663	604	614	446	437	615	630	623	736	820
Females	1,292	858	784	535	649	802	1,052	959	857	1,167
Days sick per 1,000 population:										
Males	168,287	23,513	22,163	12,566	11,827	16,571	20,718	27,257	42,104	54,431
Females	48,753	35,176	29,601	13,967	23,694	28,956	46,788	33,415	38,653	73,389
Days sick per case:										
Males		38.9	36.1	28.1	25.9	26.9	32.9	43.7	57.2	66.4
Females		41.0	37.7	26.1	36.5	36.1	44.5	34.8	45.1	62.9
Disabling [4] illness:										
Cases per 1,000 population:										
Males	2,722	355	358	284	288	367	368	344	409	455
Females	751	493	456	353	379	478	518	646	510	555

[1] Cases represent periods of illness regardless of the number of diagnoses; that is, these totals for all causes are the sums of data for cases with sole or primary diagnoses. Cases refer to those that lasted for 1 or more days including those with prior onset that extended into the study year and those still sick at the last visit; days refer to duration within the study year only but on both complete and incomplete cases. Illness from accidents is included along with that due to disease. For other details of computation, see notes to tables 7–14.

[2] Gainfully occupied persons except farmers and farm laborers.

[3] Rates in the form of cases or days per 1,000 population are adjusted by the direct method to the age distribution of the white population 15 years old and over in the death registration States in 1930 as a standard population; this population is given for specific ages in table 1 of a preceding paper (*4*). The adjustment method involves the weighting of the age specific rates for the canvassed population according to the age distribution of the standard population. The details of the process are given under the heading of "corrected death rates" in Pearl (*23*) pp. 269–271.

Figures in the "adjusted" column on days per case represent the result of dividing the adjusted rate for days per 1,000 by the adjusted rate for cases per 1,000.

[4] Disability among these gainfully employed persons means time lost from work on account of illness.

[5] Rates plotted in fig. 2 as 55 and over: Females, all except female genital and puerperal, total cases, 940; disabling cases, 522; bed cases, 418; days sick, 47,985; days disabled, 5,672; days in bed, 3,746.

TABLE 2.—*Age and sex incidence of illness from all causes as measured by various types of rates for gainfully occupied persons in 8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*—Continued

Sex and type of rate	All ages 15 years and over			Age						
	Number of cases or days	Adjusted	Crude	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
	All causes—Continued									
Disabling illness—Con.										
Days disabled per 1,000 population:										
Males	42, 231	6, 036	5, 562	3, 657	3, 528	5, 432	5, 177	4, 912	9, 755	14, 802
Females	10, 060	6, 272	6, 108	3, 244	5, 796	7, 531	6, 635	7, 306	5, 163	7, 055
Disabled days per disabling case:										
Males	-------	17. 0	15. 5	12. 9	12. 2	14. 8	14. 1	14. 3	23. 8	32. 5
Females	-------	12. 7	13. 4	9. 2	15. 3	15. 8	12. 8	11. 3	10. 1	12. 7
Bed illness:										
Cases per 1,000 population:										
Males	2, 133	277	281	202	218	289	289	272	320	377
Females	641	420	389	269	341	422	430	558	367	556
Days in bed per 1,000 population:										
Males	17, 324	2, 360	2, 282	1, 410	1, 275	2, 401	2, 141	1, 951	4, 181	4, 389
Females	4, 705	3, 165	2, 857	1, 560	2, 879	3, 606	2, 511	3, 347	2, 531	7, 055
Days in bed per bed case:										
Males	-------	8. 5	8. 1	7. 1	5. 8	8. 3	7. 4	7. 2	13. 1	11. 6
Females	-------	7. 5	7. 3	5. 8	8. 4	8. 5	5. 8	6. 0	6. 9	12. 7
	All causes except genital and puerperal									
All illness:										
Cases per 1,000 population:										
Males	4, 647	602	612	446	437	614	629	621	729	802
Females	1, 215	818	738	509	604	734	993	932	857	1, 167
Days sick per 1,000 population:										
Males	167, 548	23, 271	22, 066	12, 506	11, 327	16, 557	20, 693	27, 216	41, 776	52, 030
Females	44, 079	32, 547	26, 763	13, 538	20, 941	25, 653	42, 423	29, 082	38, 653	73, 389
Days sick per case:										
Males	-------	38. 7	36. 1	28. 1	25. 9	27. 0	32. 9	43. 8	57. 3	64. 8
Females	-------	39. 8	36. 3	26. 6	34. 7	34. 9	42. 7	31. 2	45. 1	62. 9
Disabling[4] illness:										
Cases per 1,000 population:										
Males	2, 713	353	357	284	288	366	368	343	406	437
Females	699	467	424	335	353	424	485	633	510	555
Days disabled per 1,000 population:										
Males	41, 871	5, 925	5, 514	3, 657	3, 528	5, 425	5, 177	4, 896	9, 478	13, 832
Females	9, 313	5, 009	5, 655	3, 029	5, 457	6, 585	6, 189	7, 293	5, 163	7, 055
Disabled days per disabling case:										
Males	-------	16. 8	15. 4	12. 9	12. 2	14. 8	14. 1	14. 3	23. 4	31. 6
Females	-------	12. 7	13. 3	9. 1	15. 5	15. 6	12. 8	11. 5	10. 1	12. 7
Bed illness:										
Cases per 1,000 population:										
Males	2, 124	275	280	202	218	288	289	271	317	359
Females	593	396	360	255	318	368	401	544	367	556
Days in bed per 1,000 population:										
Males	17, 097	2, 290	2, 252	1, 440	1, 275	2, 395	2, 141	1, 942	4, 014	3, 766
Females	4, 215	2, 922	2, 559	1, 436	2, 709	2, 916	2, 235	3, 327	2, 531	7, 055
Days in bed per bed case:										
Males	-------	8. 3	8. 0	7. 1	5. 8	8. 3	7. 4	7. 2	12. 7	10. 5
Females	-------	7. 4	7. 1	5. 6	8. 5	7. 9	5. 6	6. 1	6. 9	12. 7
	Population									
Males	7, 593	-------	-------	327	600	2, 020	2, 437	1, 458	584	167
Females	1, 647	-------	-------	275	422	429	307	147	49	18

shown in figure 2 and will be used in making comparisons. Considering all cases (disabling and nondisabling) for all causes except genital and puerperal diagnoses, the rates for persons aged 15 years and over were 602 and 818 per 1,000 for working males and females, respectively, an excess of 36 percent for females. In terms of sick days (disabling and nondisabling) per 1,000 persons, the excess for working females over males was 40 percent.

As in the case of all females, bed cases for working females (396 per 1,000) showed a greater excess over males (275 per 1,000) than total cases, 44 percent for all causes except genital and puerperal. In terms of bed days per 1,000, the rate for gainfully employed females was 28 percent above that for employed males; among all females the excess over males in this bed day rate was greater than the excess in the bed case rate.

In the working population, disabling cases per 1,000 showed slightly less excess for females over males than was true for total (disabling and nondisabling) cases; disabled days per 1,000 showed no excess for all working females, but there was an excess for those from 20 to 55 years of age (fig. 2). The numbers of working females above 55 years are very small and the rates are unreliable.

Table 3 summarizes the rates for the two sexes and shows ratios of female to male rates of the various types for the general and the working population. For the group of all causes except genital and puerperal, the three case rates show greater relative excesses for females of the working population than for the general population over 15 years of age. Of the three rates expressed in days per 1,000 one shows no excess for females in either population group and the other two show smaller excesses of females over males in the working than in the general population.

In terms of the percentage of persons sick one or more times during the 12 months of observation, females also show higher rates than males (fig. 3 and table 4). Employed women, with 50 percent sick one or more times, are definitely above employed men with 42 percent, a relative excess of 18 percent. In the right of figure 3 is shown the percentage of persons sick three or more times; 5.1 percent of males were sick three or more times during the year as compared with 7.7 percent of females, a relative excess of 51 percent for females. This indicates that a definitely higher percentage of females are sick frequently, but no data are available for estimating in these terms how much of the excess is due to female genital and puerperal diagnoses.

Thus the various types of illness rates almost invariably indicate more sickness among women than men, including more among gainfully occupied women than men of that category. The elimination of diagnoses not common to the two sexes reduces but by no means

TABLE 3.—*Ratio of the illness rate for females to that for males of the ages 15 and over for the total surveyed population and for gainfully occupied persons—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

Type of rate	Ratio of female to male rate (male rate=100)		Actual rates during year for persons 15 years old and over (adjusted)[1]			
			Males		Females	
	Total population	Gainfully occupied	Total population	Gainfully occupied	Total population	Gainfully occupied
	All causes					
Total[2] cases per 1,000	147	142	619	604	908	858
Disabling[3] cases per 1,000	143	139	356	355	509	493
Bed[4] cases per 1,000	167	152	276	277	461	420
Sick[2] days per 1,000	165	150	25,234	23,513	41,753	35,176
Disabled[3] days per 1,000	121	104	6,951	6,036	8,434	6,272
Bed[4] days per 1,000	181	134	2,895	2,360	5,230	3,165
Sick days per case	113	105	40.7	38.9	46.0	41.0
Disabled days per disabling case	85	75	19.5	17.0	16.6	12.7
Bed days per bed case	108	88	10.5	8.5	11.3	7.5
	All causes except genital[5] and puerperal					
Total[2] cases per 1,000	128	136	619	602	793	818
Disabling[3] cases per 1,000	117	132	356	353	417	467
Bed[4] cases per 1,000	134	144	276	275	371	396
Sick[2] days per 1,000	146	140	25,234	23,271	36,793	32,547
Disabled[3] days per 1,000	99	100	6,951	5,925	6,853	5,909
Bed[4] days per 1,000	144	128	2,895	2,290	4,169	2,922
Sick days per case	114	103	40.7	38.7	46.4	39.8
Disabled days per disabling case	84	76	19.5	16.8	16.4	12.7
Bed days per bed case	107	89	10.5	8.3	11.2	7.4

[1] Adjusted by the direct method to the age distribution of the white population of the United States registration States in 1930, as described in note to table 2. Figures for "adjusted" days per case represent the result of dividing the adjusted rate for days per 1,000 by the adjusted rate for cases per 1,000.

[2] Including both disabling and nondisabling cases whose symptoms lasted for 1 or more days.

[3] Disability refers to inability to work, attend school, care for home, or pursue other usual activities for 1 or more days regardless of employment status and age.

[4] Including all cases in which the patient was in bed for 1 or more days; all hospital cases are counted as bed cases.

[5] Male genital diseases are numerically unimportant so have not been deducted in the rates for the total population.

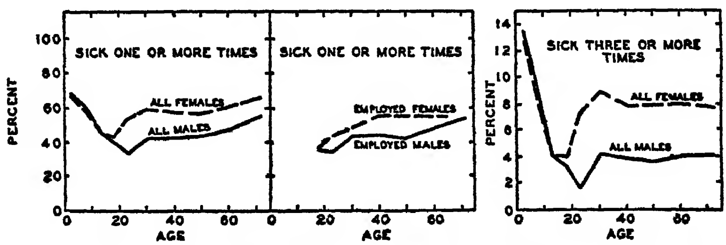

FIGURE 3.—Percentage of males and females of specific ages who were sick the specified number of times during the year under observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31.

TABLE 4.— *Proportion of all and of gainfully occupied males and females of specific ages who were sick the specified number of times during the year under observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

Times sick during 12-month period	Total[1]: Number of persons	Total[1]: Adjusted[2]	Total[1]: Crude	Age[6]: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
			Percentage sick the specified number of times										
Total surveyed population:													
Sick one or more times[3]													
Both sexes	20,220	51.8	52.6	67.6	58.5	45.9	41.1	44.7	51.7	49.8	48.9	53.2	61.0
Male	9,212	46.9	48.9	68.0	59.8	46.1	39.5	33.5	41.9	42.7	43.1	47.4	55.4
Female	11,008	56.1	56.2	67.2	57.2	45.7	42.8	52.9	59.0	57.0	55.9	60.1	65.4
Sick 3 or more times:													
Both sexes	2,658	6.5	6.9	13.1	8.6	4.1	3.6	4.8	7.0	5.7	5.5	5.9	6.1
Male	1,111	5.1	5.9	13.5	9.2	4.1	3.3	1.5	4.2	3.7	3.6	4.1	4.1
Female	1,547	7.7	7.9	12.6	8.0	4.1	3.9	7.2	9.1	7.8	7.9	8.1	7.7
Gainfully occupied persons:[4]													
Sick 1 or more times:[3]													
Male	3,224	42.3	42.5	------	------	------	35.5	34.7	42.8	43.1	42.1	48.1	53.9
Female	778	50.1	47.2	------	------	------	36.7	43.1	48.0	55.7	55.1	53.1	61.1
			Number of persons under observation[5]										
Total surveyed population:													
Male	18,835	------	------	2,608	2,833	2,310	1,546	922	2,426	2,990	1,852	812	462
Female	19,585	------	------	2,493	2,906	2,274	1,555	1,257	3,257	2,958	1,513	682	587
Gainfully occupied persons.[4]													
Male	7,593	------	------	------	------	------	327	600	2,020	2,437	1,458	584	167
Female	1,647	------	------	------	------	------	275	422	429	307	147	49	18

[1] For the total surveyed population this total refers to all ages including a few of unknown age, but exclusive of infants born during the study year; for gainfully occupied persons, this total refers to persons 15 years old and over.
[2] Percentages for all ages and for ages 15 and over are adjusted to the age distribution of the white population of the death registration States in 1930.
[3] Percentage not sick can be obtained by subtracting from 100.0 the percentage sick 1 or more times.
[4] Gainfully occupied persons exclusive of farmers and farm laborers.
[5] All except about 2 percent (including deaths) were under observation during the whole 12 months; infants born during the study year are excluded.
[6] Rates plotted in fig. 3 as 55 and over: Gainfully occupied females, 55.2 percent.

eliminates the female excess.[19] Rates based on sick benefit and industrial establishment records of absences of employees from work confirm this excess of illness among females over males in terms of both cases and days of disability (*14, 15, 16, 20*). The few reports that show sickness by occupation indicate that the excess of illness among females persists when males and females engaged in the same specific occupation [20] are compared (*14, 19*).

[19] When the data shown for all occupied persons in table 2 are tabulated separately for (*a*) professional, clerical, sales, and merchant occupations, and (*b*) skilled and unskilled laboring occupations, the excess in illness of females over males persists in both groups, although the numbers of persons under observation are small, particularly for females in skilled and unskilled labor.

[20] Absences for 1 day or longer on account of sickness among employees of a public utility company (*19*) with a liberal plan of sick leave with pay showed the following annual rates for the period 1933–37: Office clerks, 954 cases per 1,000 males as compared with 1,833 for female clerks and 1,654 for female stenographers; the few telephone operators were an exception, with rates about the same for males and females but the

On the other hand, the death rate in the various age groups is invariably lower for females than males in the general population. Because of the small number of deaths in the surveyed population, the mortality rates shown in figure 1 and table 1 are for the total United States registration States for the approximate period of the survey.[21]

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numbers of persons observed were too few to give reliable rates. The small number of office cleaners or charwomen had a rate of 3,102 cases per 1,000 as compared with 1,404 for linemen, the highest rate for a male occupation. In days of disability per person under observation the females were also higher, 7.0 per male clerk on the payroll as compared with 10.7 for both female clerks and female stenographers; office cleaners had a rate of 15.9 days per person observed as compared with 11.1 for linemen, the highest rate for a male occupation. Without respect to occupation, females showed a higher rate than males in nearly every disease group, neurasthenia showing the greatest relative excess.

In the soap industry during 1930–34 (*14*), illness causing disability for 8 calendar days or longer occurred at the following rates: Office workers, 33.2 cases per 1,000 annually for males as compared with 75.3 for females; packing machine operators, 98.4 annual cases per 1,000 males and 138.2 per 1,000 females. Days lost from work on account of these cases disabling for 8 days or longer were: 1.0 days per male office worker as compared with 2.3 days per female office worker; 3.3 days per male packing-machine operator and 5.3 days per female packing-machine operator on the pay roll. None of the rates quoted above are adjusted for age differences, but the report on the soap industry which shows adjusted case rates indicates that the large excess for females over males is not due to age differences.

21 The few deaths in the surveyed sample agree with the registration States in showing definitely lower rates for females. The death rates in the surveyod group are based on both the families observed for a full 12-month period and those observed for less than that time, all part-time persons in both groups being counted in the population for only the actual time under observation. As a death in the family was sometimes the reason for the discontinuance of reports, it was necessary to use both groups of families in computing the death rates. Crude death rates were: Full-time families 6.0, and part-time 14.9 per 1,000 person-years of experience. Infant mortality rates were· Full-time families 43, and part-time 118 deaths under 1 year per 1,000 live births. The relative age distributions of the full-time and part-time groups are quite similar, so that their crude rates are comparable.

Mortality from all causes per 1,000 population as reported in periodic canvasses of white families in 18 States during 12 consecutive months, 1928–31

[Families observed from 3 to 12 consecutive months]

Sex	All ages			Age							
	Number of deaths	Adjusted	Crude	Under 5	5–14	15–24	25–34	35–44	45–54	55–64	65 and over
		DEATH RATE PER 1,000 DURING YEAR									
Both sexes	295	9.58	6.90	11.06	1.40	2.97	2.71	4.57	6.83	21.07	77.13
Male	161	10.76	7.68	12.17	2.28	2.97	3.37	4.83	6.45	19.41	93.17
Female	134	8.66	6.14	9.91	.52	2.96	2.22	4.31	7.30	23.04	64.62
	POPULATION (YEARS OF LIFE)										
Both sexes	42,780			6,150	11,463	5,730	6,265	6,565	3,658	1,614	1,102
Male	20,971			3,122	5,704	2,691	2,667	3,313	2,015	876	483
Female	21,809			3,028	5,759	3,039	3,598	3,252	1,643	738	619

"All ages" includes a few of unknown age; unknown sex is allocated equally to the two sexes. Rates adjusted by the *direct* method as described in note to table 1.

All sickness data are based on the full-time families only; no material differences appeared between sickness rates for full- and part-time families. Crude rates for all ages for total cases (disabling and nondisabling) were: Full-time families 850, and part-time 934 cases per 1,000 person-years of experience. For similar cases with onset within the study period the rates were: Full-time families 794, and part time 838 cases per 1,000 person-years of experience. Rates for cases with onset prior to but existing at the beginning of the study year were: Full-time families 56, and part-time 49 cases per 1,000 individuals entering the study (exclusive of infants born during the study who would have no prior cases). For cases that disabled for 1 or more days the rates were: Full-time families 516, and part-time 556 cases per 1,000 person-years of experience. For cases that confined the patient to bed for 1 or more days the rates were: Full-time families 434, and part-time 464 cases per 1,000 person-years of experience. Rates for hospitalized illnesses were: Full-time families 61 and part-time 63 hospital in-patient admissions per 1,000 person-years of experience.

For all ages the rate for all causes was 16 percent less for females than males and the rate for all causes except female genital and puerperal was 18 percent less than for males.

No satisfactory data are available for the United States for a comparison of the mortality of men and women in similar occupations. Data in the recent English report on occupational mortality (*22*) make it possible to compare death rates of males and single females engaged in the same occupation; married females are classified according to the occupation of the husband and cannot be used in the comparison. Table 5 shows data for all specific occupations with sufficient numbers of each sex to yield reliable rates. Some of the 18 occupations shown have rather small numbers. Since the data are all available in the original report, the population and numbers of deaths are given for the total group of 20–64 years only. The occupations were selected as those in which males and females would be actually performing the same tasks.

Rates for all single females are consistently less in the various age groups than those for all males, and rates for all married women are slightly less than those for all single women except at 20–24 years.

TABLE 5.—*Mortality from all causes among men and women 20–64 years of age engaged in specific occupations,[1] England and Wales, 1930–32*

Occupation [2] and sex	Total, ages 20–64		Age					Number of deaths, ages 20–64	Years of life,[4] ages 20–64
	Adjusted [3]	Crude	20–24	25–34	35–44	45–54	55–64		
	Annual death rate per 1,000 population								
All persons:									
All males	8.03	8.59	3.28	3.46	5.59	11.14	23.55	292,375	34,026,483
Married females	5.97	6.52	2.98	3.11	4.20	7.66	16.43	156,491	23,988,798
Single females	6.37	5.06	2.74	3.33	4.76	8.63	16.98	56,936	11,243,097
Teachers, not music:									
All males (74)	5.44	5.99	2.91	2.35	3.08	6.75	17.74	1,446	241,320
Single females (37)	3.97	3.64	1.36	1.72	3.01	5.48	11.52	1,704	484,623
Typists, clerks, and draftsmen:									
All males (81–83)	7.73	6.53	2.77	3.22	5.21	10.85	23.54	12,005	1,837,647
Single females (46)	4.42	2.54	1.77	2.31	3.31	5.85	12.10	2,822	1,112,883
Domestic servants (indoor):									
All males (76)	7.88	7.34	3.17	3.35	4.60	10.35	22.02	1,318	179,583
Single females (39)	7.04	5.40	2.34	3.18	4.95	9.80	20.82	12,488	2,311,662
Waiters and waitresses:									
All males (79)	10.74	8.90	4.65	4.53	8.34	14.13	30.87	565	63,450
Single females (42)	7.30	3.84	3.19	3.39	5.50	7.14	24.30	461	120,165
Barmen and barmaids:									
All males (78)	12.53	9.32	3.24	4.94	11.29	19.57	31.65	680	72,927
Single females (41)	6.71	3.25	2.08	2.95	5.63	6.30	23.04	164	50,403
Hairdressers, barbers, manicurists, chiropodists:									
All males (80)	9.80	10.11	4.48	4.39	6.75	14.11	27.22	1,172	115,902
Single females (44)	4.10	2.17	1.95	1.79	2.40	7.00	10.55	107	49,410
Inn and hotel keepers, beer sellers, publicans:									
All males (77)	12.27	19.31	4.69	4.37	9.24	17.91	35.61	3,777	195,549
Single females (40)	8.11	9.07	8.77	5.77	3.86	5.50	24.60	91	10,038

[1] Data from Registrar General's Decennial Supplement (*22*).
[2] Numbers in parentheses show the occupational group number used in the original mortality report (*22*).
[3] Adjusted by the direct method to the age distribution of the white population of the United States registration States in 1930, as described in note to table 2.
[4] Years of life equals 3 times 1931 census population for the occupation.

TABLE 5.—*Mortality from all causes among men and women 20–64 years of age engaged in specific occupations, England and Wales, 1930–32*—Continued

Occupation and sex	Total, ages 20–64: Adjusted	Total, ages 20–64: Crude	Age 20–24	Age 25–34	Age 35–44	Age 45–54	Age 55–64	Number of deaths, ages 20–64	Years of life, ages 20–64
	Annual death rate per 1,000 population								
Proprietors and managers of retail grocery, provision, meat, dairy, and greengrocery stores:									
All males (60, 61)	8.82	11.20	4.20	3.53	5.97	12.06	26.39	6,048	540,021
Single females (63, 64)	5.41	6.46	2.86	2.39	3.69	7.28	15.50	204	31,566
Proprietors and managers of retail textile and other clothing stores:									
All males (230)	6.92	9.36	3.48	2.97	3.91	9.19	21.96	1,127	120,390
Single females (66)	3.87	4.78	2.02	1.74	2.60	5.73	10.30	193	40,386
Salesmen in retail grocery, provision, meat, dairy, and greengrocery stores:									
All males (64, 65)	8.26	5.65	2.80	3.44	5.56	11.84	24.97	2,485	439,572
Single females (30, 31)	5.25	2.69	1.87	2.42	4.02	8.09	13.48	288	107,184
Salesmen in retail textile and other clothing stores:									
All males (239)	7.62	5.98	3.38	3.96	4.98	11.26	20.20	556	92,991
Single females (33)	4.98	2.65	1.61	2.65	3.50	6.86	14.10	593	223,899
Textile [5] weavers:									
All males (31, 32)	7.55	8.81	3.06	3.54	4.46	10.58	22.99	1,378	156,447
Single females (12)	7.08	5.02	2.29	2.60	4.77	9.63	23.10	1,276	254,175
Textile [5] card, comb, and frame tenters, box minders:									
All males (183, 184)	12.65	13.14	3.61	3.25	11.61	20.05	34.42	332	25,269
Single females (10)	6.55	4.04	2.34	2.84	3.99	8.21	22.00	313	77,508
Textile [6] winders, reelers, beamers, warpers, and silk doublers:									
All males (302)	9.53	10.51	2.76	3.26	5.60	14.38	31.43	183	17,415
Single females (14)	7.10	4.87	2.63	3.13	5.11	9.50	21.23	684	140,412
Textile [7] doublers and doubling frame tenters (not silk), and silk throwsters:									
All males (185)	7.01	7.14	1.71	3.96	5.84	8.78	19.50	92	12,888
Single females (13)	6.95	4.17	2.80	3.66	5.52	11.88	14.29	109	26,118
Textile [6] spinners and piecers (mule, ring, cap or flyer) [8]:									
All males (29, 30)	8.17	7.61	3.42	3.24	5.03	10.16	27.51	1,086	142,743
Single females (11)	11.96	5.77	4.13	4.59	8.48	17.60	35.40	311	53,862
Textile [6] lookers and examiners, burlers, and menders:									
All males (305)	7.36	8.32	4.37	2.39	6.18	9.34	20.83	128	15,393
Single females (16)	8.11	5.48	2.81	3.86	7.44	12.60	18.10	272	49,590
Hosiery frame tenters and machine knitters:									
All males (186)	6.73	6.29	3.43	3.65	3.36	8.05	21.90	146	23,202
Single females (15)	7.22	4.33	3.19	3.48	7.00	7.27	20.40	186	42,984

[5] Males in cotton and wool only, but females in all textiles.
[6] All textiles except as indicated by the occupation title.
[7] Males in cotton only, but females in all textiles except as indicated by the occupation title.
[8] Mule spinners are mostly men and ring spinners mostly women.

The first 11 occupations shown in table 5 are varied and the last 7 are in the textile industry. All of the first 11 occupations show higher rates for males than for single females for the total group 20–64 years when adjusted for age differences. With the exception of domestic servants, for which the excess for males over females is only 5 percent, the excesses range from 37 percent for teachers to 139 percent for hairdressers and barbers. The English report cautions that occupations of single women are more or less changing and may have been omitted from the death certificate for a person reported in the census as an occupied individual. However, the death rates of single females

in the 10 occupations discussed above might be increased considerably to allow for this error and yet be less than the death rates of males in the same specific occupation.

The 7 occupations in the textile industry are not so consistent; in 4 of them the rates for males are approximately equal to or greater than those for single females, but in the other 3 occupations the rates are higher for females.[22]

To summarize, the opposite showing for illness and mortality of men and women may lead some to dismiss the sex difference in sickness rates as an artifact, but the consistency of various kinds of data from different independent sources in indicating a higher illness rate for females suggests that the difference is real. The sickness picture varies from the mortality situation in several ways: (*a*) The most frequent causes of illness, either total, disabling, or bed cases, are not the most important causes of death; (*b*) the causes of the greatest number of days of sickness, either total, disabling, or in bed, are not the causes of the largest numbers of deaths; (*c*) women are sick more than men, but the death rate is lower for women; thus the life expectancy of women is greater than for men in spite of more frequent illness. Some of these differences are discussed by Sydenstricker in an early Hagerstown report (*26*).

III. FREQUENCY AND DURATION RATES FOR BROAD DISEASE GROUPS

Preceding papers in this series have presented incidence rates by age for total cases for broad diagnosis groups (*5*) and for specific diseases (*6*). The present section presents by age and sex for broad diagnosis categories (*a*) incidence rates per 1,000 for total cases, disabling cases and bed cases, (*b*) rates for total days sick, days disabled, and days in bed per 1,000 and (*c*) total, disabled, and bed days per case. Since the data are shown only in broad disease groups, all the rates are based on sole or primary causes only.[23] Rates per 1,000 for all ages have been adjusted to the age distribution of the white population of the registration States in 1930 and days per case and percentages of cases for all ages are based on the adjusted rates for cases and days per 1,000.

Figure 4 shows the relative importance of the different disease groups as causes of illness according to various criteria. The first bar shows the percentage of the total cases (disabling and nondisabling) that were due to various causes and the second bar shows the

[22] A report on Women's Work (*29*) from the International Labor Office quotes sickness rates for insured workers in various countries as being usually higher for women than men. Mortality data from the Leipzig (Germany) Sickness Insurance Society are quoted as showing higher death rates for working women than men from 15 to 35 years, but lower rates for women from 35 to 60 years of age. Data for the German general population are quoted as showing lower death rates for women from 15 to 60 ydars except for the ages 25 to 35 years.

[23] Only 4.3 percent of the illnesses were designated as due to more than one cause.

proportion of the total days of sickness (disabling and nondisabling) that were due to the various diagnoses. In terms of total cases, minor respiratory diseases represent 33.7 percent of all cases, followed by accidents, 9.0 percent, communicable diseases, 8.7 percent, and minor digestive diseases, 7.0 percent. The order of importance according to the total days of sickness (disabling and nondisabling) is quite different, the degenerative group coming first; this degenera-

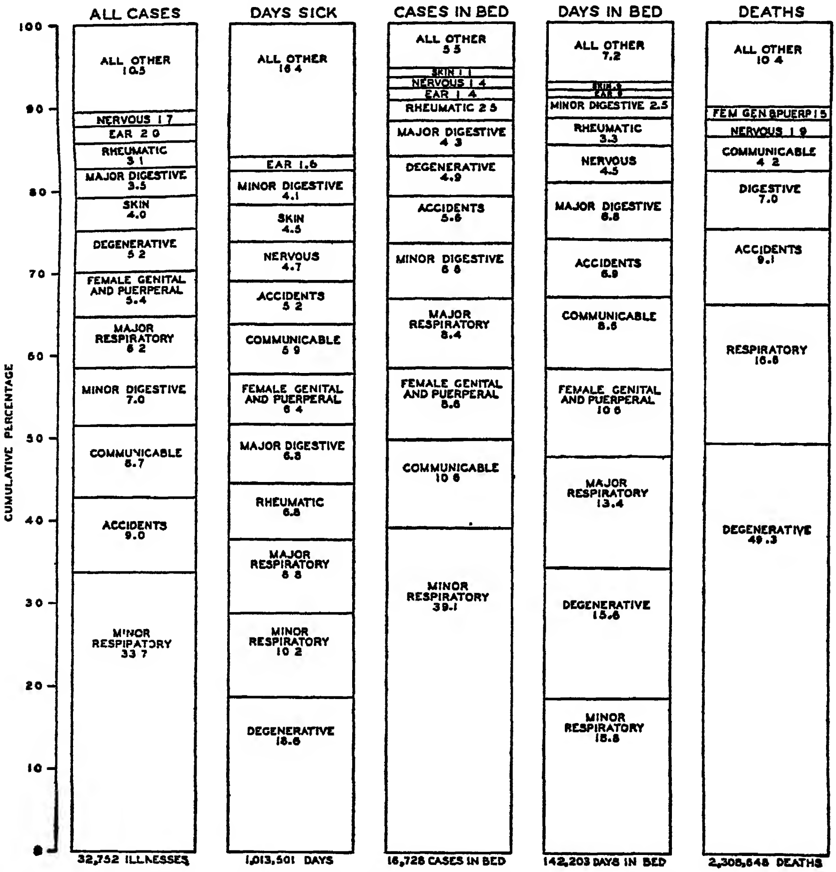

FIGURE 4.—Important causes of illness as measured by percentages of various types of cases and days—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31. (For details regarding specific diseases included in each broad group, see footnote to table 7.)

tive group includes heart, kidney (except pyelitis), bladder and prostate diseases, high blood pressure, arteriosclerosis, cerebral hemorrhage and paralysis, diabetes, benign tumor (except of the female genital organs), cancer, and other ailments of old age. The criterion for inclusion of a specific disease in this group was partly statistical in that the age curve of its incidence (*6*) was given considerable weight.

The degenerative diseases, which cause 18.6 percent of all sick days, are seventh in terms of all cases of sickness, causing only 5.2 percent of the total cases. Minor respiratory diseases, which cause 33.7 percent of the total cases, are second in terms of days of sickness, with 10.2 percent of the total days, followed by other (major) respiratory diseases, with 8.8 percent of the total.

The third and fourth bars in figure 4 refer to illness that confined the patient to bed for one or more days; the third bar refers to bed cases and the fourth bar to the number of days confined to bed on account of illness. Both of these bars disregard entirely the cases that were not confined to bed and the bar for days in bed also disregards for bed cases the days of sickness prior to and following the period in bed. Of the total bed cases, minor respiratory diseases were responsible for 39.1 percent, followed by communicable diseases, 10.6 percent, and female genital and puerperal diagnoses, 8.6 percent. Of the total days confined to bed on account of illness, minor respiratory diseases were also the major cause, with 18.8 percent, but degenerative diseases, which are seventh in the frequency of bed cases, are second in terms of bed days, with 15.6 percent of the total. Next come major respiratory diseases with 13.4 percent, and female genital and puerperal diagnoses with 10.6 percent of the total days in bed.

The last bar shows a similar distribution of deaths according to cause in the registration States during 1929–30, the approximate period of the sickness survey. It is indicated in a preceding article (*4*, fig. 1) that the percentages of deaths due to different causes are roughly the same for the survey data as for the registration States. The degenerative [24] diseases cause practically half of the total deaths, 49.3 percent, followed by respiratory [24] diseases, 16.6 percent, and accidents, 9.1 percent.

Frequency and duration rates at specific ages for each sex.—Comparisons of the various measures of illness from all causes among males and females may well be extended to various causes of illness, for the relative differences between the sexes in illness rates are greater for some diagnoses than others. Figures 5 and 6 show for males and females of specific ages four types of rates for 12 diagnosis groups: (*a*) The frequency of all cases (appendix, table 7), (*b*) the frequency of cases that confined the patient to bed for one or more days (appendix, table 9), (*c*) the annual number of days in bed per 1,000 persons (appendix, table 12), and (*d*) the number of days in bed per bed case (appendix, table 13). Similar rates for sick days (disabling and nondisabling, appendix, table 10), disabling cases (appendix, table 8),

[24] These broad groups selected as suitable for morbidity studies are too broad for analysis of mortality. The most important diseases in the degenerative category with the percentage of all deaths which they cause are: Heart diseases, 18.8; cancer (all sites), 9.2; kidney diseases, 8.0; and cerebral hemorrhage and paralysis, 8.0 percent. In the respiratory group the important diseases are: Pneumonia, 7.8, and respiratory tuberculosis, 4.8 percent of all deaths.

disabled days (appendix, table 11), and deaths (appendix, table 14) are shown in tabular form only. The detailed tables by age are given in the appendix, but table 6 summarizes the data for males and females of all ages.

TABLE 6.—*Ratio of illness rates from certain causes for females of all ages to those for males—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31; deaths among the white population of the registration States, 1929–30*

[Sole or primary diagnoses only]

Diagnosis group [1]	All cases	Sick days	Disabling cases	Disabled days	Bed cases	Bed days	Deaths	Sick days per case	Disabled days per disabling case	Bed days per bed case
	Ratio of adjusted rate per 1,000 for females to that for males (Male rate=100)							Ratio of days per case for females to that for males (Male average=100)		
All causes	127	152	124	114	138	154	84	120	92	113
All causes except female genital and puerperal	116	136	109	98	119	129	82	118	90	109
Minor respiratory diseases	116	123	110	109	116	131	84	107	100	112
Other respiratory diseases	107	123	104	93	107	119		116	90	111
Minor digestive diseases	119	145	128	159	143	150	81	122	125	106
Other digestive diseases	143	113	141	105	151	166		79	75	110
Communicable diseases	104	102	103	98	106	121	83	98	95	114
Ear and mastoid diseases	99	79	108	97	109	100	72	80	90	97
Nervous diseases, except cerebral hemorrhage, paralysis, neuralgia, and neuritis	282	185	212	61	239	115	69	65	29	48
Rheumatism and related diseases	136	148	106	92	123	144	124	109	87	117
Degenerative diseases	149	173	142	102	152	157	92	116	72	103
Skin diseases	106	120	87	125	96	100	80	113	145	103
Accidental injuries	64	73	58	67	74	82	37	114	116	110
All other diseases	160	167	147	136	170	135	84	104	93	79
	Adjusted [2] rates per 1,000 during year							Days per case [3]		
All causes:										
Male	720.3	23,217	435.1	7,107	345.0	3,046	11.982	32.2	16.3	8.8
Female	915.4	35,241	540.7	8,118	475.6	4,699	10.124	38.5	15.0	9.9
All causes except female genital and puerperal:										
Female	833.1	31,679	474.4	6,989	410.7	3,943	9.796	38.0	14.7	9.6
Minor respiratory diseases:										
Male	256.9	2,674	174.4	1,247	149.7	637		10.4	7.1	4.3
Female	296.9	3,300	192.4	1,362	173.8	833	1.995	11.1	7.1	4.8
Other respiratory diseases:										
Male	49.2	2,309	36.9	966	33.7	472	1.679	47.0	26.2	14.0
Female	52.4	2,846	38.3	898	36.0	563		54.3	23.5	15.6
Minor digestive diseases:										
Male	52.2	989	27.7	169	22.6	80		18.9	6.1	3.5
Female	62.1	1,436	35.4	268	32.3	120	.849	23.1	7.6	3.7
Other digestive diseases:										
Male	23.8	1,899	16.1	471	14.1	199	.690	79.9	29.2	14.1
Female	34.0	2,151	22.7	496	21.3	330		63.3	21.8	15.5
Communicable diseases:										
Male	69.9	1,721	54.4	997	42.6	305	.508	24.6	18.3	7.2
Female	72.8	1,759	56.0	975	45.1	369	.423	24.2	17.4	8.2
Ear and mastoid diseases:										
Male	16.4	534	7.3	105	5.5	35	.043	32.6	14.4	6.3
Female	16.2	424	7.9	102	6.0	37	.031	26.1	13.0	6.1
Nervous diseases, except cerebral hemorrhage, paralysis, neuralgia, and neuritis:										
Male	7.3	943	4.3	403	3.3	163	.243	129.7	93.9	49.5
Female	20.6	1,746	9.1	245	7.9	187	.167	84.9	27.1	23.7
Rheumatism and related diseases:										
Male	21.9	1,597	12.3	278	9.1	105	.033	73.1	22.5	11.5
Female	29.7	2,359	13.0	256	11.2	151	.041	79.6	19.6	13.5

See footnotes at end of table.

TABLE 6.—*Ratio of illness rates from certain causes for females of all ages to those for males—8,758 canvased white families in 48 States during 12 consecutive months, 1928–31; deaths among the white population of the registration States, 1929–30*—Continued.

Diagnosis group	All cases	Sick days	Disabling cases	Disabled days	Bed cases	Bed days	Deaths	Sick days per case	Disabled days per disabling case	Bed days per bed case
	Adjusted rates per 1,000 during year							Days per case		
Degenerative diseases:										
Male	34.6	4,003	19.6	1,130	16.2	486	5.668	115.6	57.6	30.0
Female	51.7	6,939	27.8	1,149	24.7	761	5.238	134.2	41.4	30.8
Skin diseases:										
Male	32.3	1,207	10.2	119	4.6	34	.030	37.4	11.6	7.5
Female	34.2	1,447	8.9	149	4.4	34	.024	42.4	16.8	7.7
Female genital and puerperal diagnoses.										
Female	82.3	3,562	66.3	1,129	64.9	757	.327	43.3	17.0	11.7
Accidental injuries:										
Male	90.4	1,750	47.3	830	26.6	295	1.466	19.4	17.6	11.1
Female	57.9	1,285	27.2	557	19.7	241	.542	22.2	20.5	12.2
All other diseases:										
Male	65.5	3,591	24.5	393	16.8	235	1.147	54.8	16.0	14.0
Female	104.7	5,986	35.9	534	28.5	317	.962	57.2	14.9	11.1

[1] For inclusions in terms of the International List of the Causes of Death, see tables 7 and 14; other details of classification, tabulation, and computation are given in footnotes to tables 7–14.
[2] Adjusted by the direct method as described in footnote to table 7.
[3] Computed by dividing the adjusted rate for days per 1,000 by the corresponding adjusted rate for cases per 1,000.

The minor respiratory diseases include coryza, colds, tonsillitis, pharyngitis, laryngitis, sore throat, bronchitis, grippe, and influenza. The recorded rates for total cases are somewhat higher for adult females than adult males; for bed cases the rates for females are higher at every age above 5 years. For females of all ages the rate for total cases and bed cases of the minor respiratory group are both 16 percent above the corresponding rates for males. Bed days per bed case is 12 percent higher for females, and days in bed per 1,000 persons is 31 percent greater for females than for males. Thus roughly half of the excess in bed days per 1,000 results from more bed cases among females and the other half from more days in bed per case. There is in neither sex any tendency toward an increasing frequency of attacks as age increases among adults, but the days in bed from these diseases per 1,000 females increases considerably with age, reflecting an increasing average duration of bed days per case.

The group designated as "other respiratory" is a miscellaneous category consisting of the various respiratory diseases not classified as minor. So far as numbers of cases go, the most frequent diagnosis in this group is tonsillectomy; other important diagnoses included are pneumonia, sinusitis, asthma, pleurisy, and respiratory tuberculosis. Because of the heterogeneous character of the diseases in the group, little can be said about it. For persons of all ages, females show a relative excess over males of 7 percent for all cases and also for bed cases, with a 19 percent excess in bed days per 1,000 persons. How-

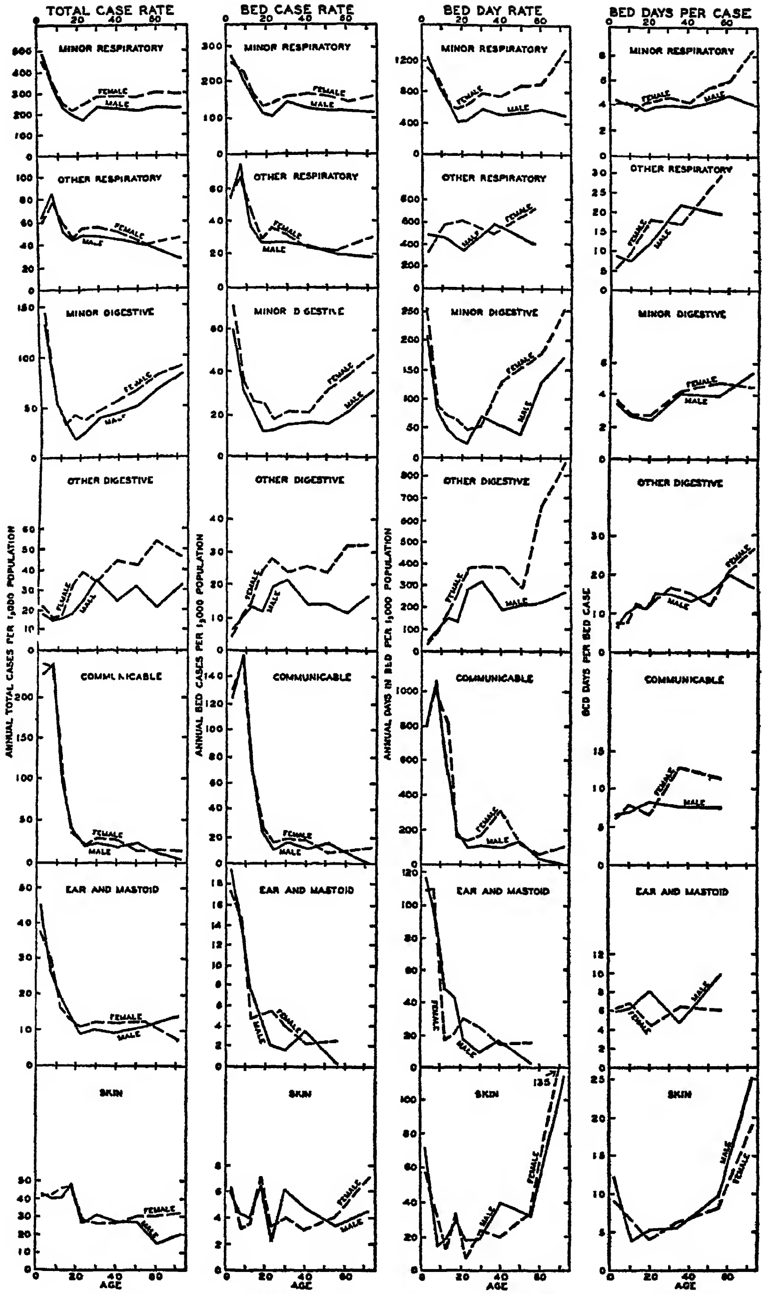

FIGURE 5.—Age and sex incidence and duration of illness from broad disease groups as measured by various types of rates—8,758 canvassed white families in 18 States during 12 consecutive months, 1928-31. (Scales are so made that the adjusted rate for all ages of both sexes represents an interval on the vertical rate scale that corresponds to 30 years on the horizontal age scale. Rates are given in the Appendix, tables 7-13, with footnotes for broader age groups used in some of the graphs.)

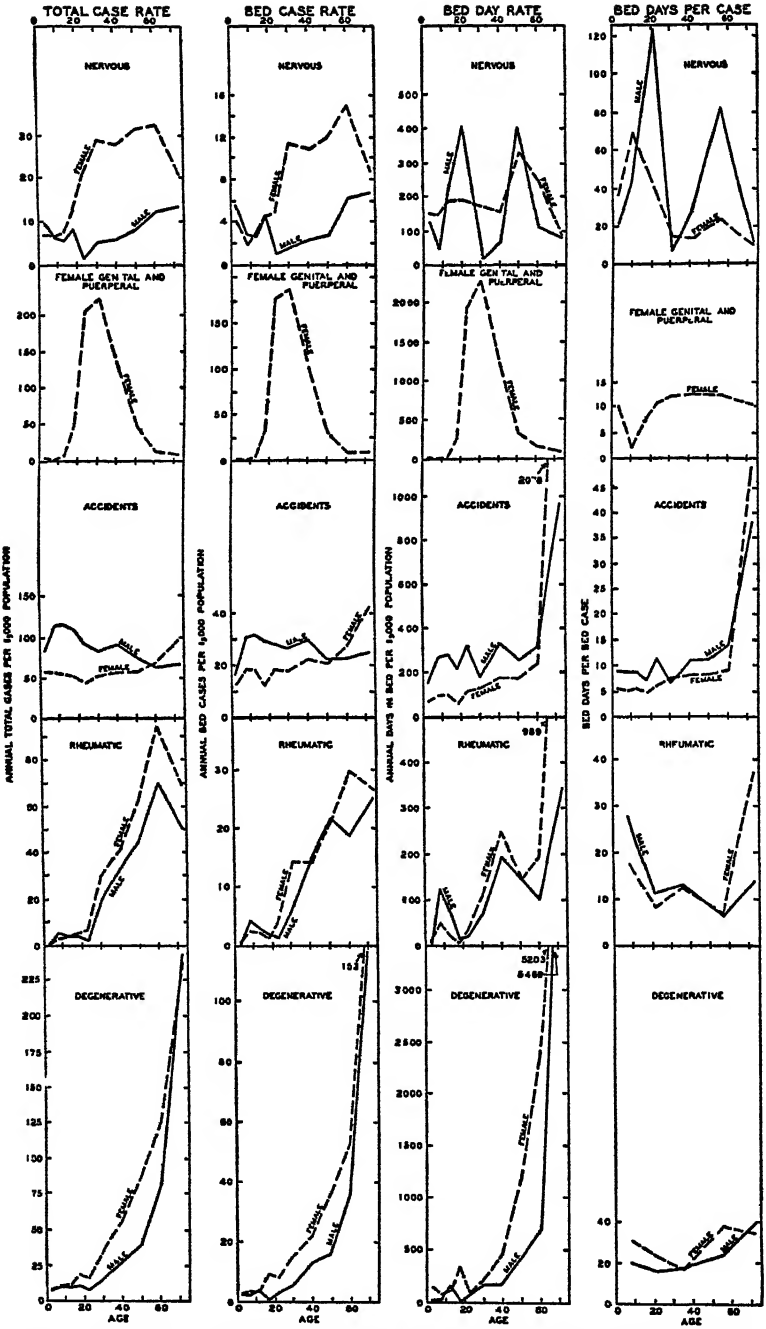

FIGURE 6.—Age and sex incidence and duration of illness from broad disease groups as measured by various types of rates (continued).

ever, the differences between the sexes are not consistent in the various ages.

The minor digestive group includes indigestion, upset stomach, gastritis, biliousness, diarrhea, and enteritis. The incidence of all minor digestive cases is 19 percent greater for females than males; the excess for females is 43 percent for bed cases, 50 percent for bed days per 1,000 population, and 6 percent for bed days per case. Thus most of the excess for females in bed days per 1,000 arises from more bed cases rather than a longer time in bed per case. The excess for females is larger among adults, but even among children there is a consistent excess in bed cases and days but not in the total cases (bed and non-bed). With respect to age, the incidence of total cases and of bed cases is high in childhood, with a minimum in youth, 15–24 years, and a gradually rising rate thereafter. As measured by days in bed per 1,000 population the increase with age among adults is greater than is indicated by the incidence of either total or bed cases, the rates among persons over 65 years being about the same as among children under 5 years.

The "other digestive" category is also a miscellaneous group including appendicitis, gall bladder and liver diseases, hernia, ulcers of the stomach and duodenum, and other diseases of the digestive tract not classified as minor. This group shows large excesses for females in terms of all three types of rates per 1,000; the excess for females over males of all ages is 43 percent for all cases, 51 percent for bed cases, and 66 percent for bed days per 1,000 population. The average days in bed per bed case was only 10 percent greater for females than males; thus the large excess for females in bed days per 1,000 results largely from more bed cases and not from more bed days per case.

These more severe diseases of the digestive system have their lowest incidence in childhood; there is considerable increase in the rates up to about 25 years of age, after which they tend to remain somewhere near level. The rate for days in bed per 1,000 females is an exception in that it increases definitely in the older ages.

Whether the acute communicable [25] diseases are measured in terms of total cases, bed cases, or bed days per 1,000 population, they are definitely concentrated in childhood. The peak in bed days per 1,000 for adult females is probably not significant, being due to 2 exceptionally long cases. Considering all ages, females show an excess over males of 4 percent for all cases, 6 percent for bed cases, 21 percent for bed days per 1,000 population, and 14 percent for bed days per case. Thus the excess in bed days per 1,000 is due more to a higher average number of bed days per case than to more bed cases. However, the differences are not consistent in the various age groups.

[25] Influenza, grippe, and respiratory tuberculosis are not included in this group of communicable diseases.

Ear diseases, consisting chiefly of earache and otitis media, are likewise highly concentrated in childhood; the maximum rates occur at the youngest ages and decline sharply as age increases. For all ages, the total case rate for females was 1 percent below that for males; for bed cases and bed days per 1,000 the female rates showed an excess over males of 9 percent and 6 percent, respectively. The number of bed days per case was 3 percent less for females than males.

Skin diseases show little variation with age in the incidence curves; however, in bed days per 1,000 population there is a rise in the older ages for each sex, reflecting an increase among older people in the days in bed per case. There is not much difference between skin disease rates for males and females; the total case rate for females of all ages shows a 6 percent excess over males; rates for bed cases are 4 percent less for females than males, and rates for bed days per 1,000 are the same for both sexes. Bed days per case are 3 percent greater for females than males.

The nervous group consists largely of neurasthenia, nervous breakdown, and nervousness but also includes the more serious mental diseases, insofar as the patient kept his status as a member of the family and was so reported by the informant.[26] These nervous diseases show the largest variation between the sexes of any of the 13 diagnosis classes, but some of the difference must be discounted because of the subjective character of the diagnoses, a factor which may result in more complete reports for the female informant than for the male members of the household upon whom she is reporting. Of the total incidence rate of 14.1 cases per 1,000 persons, 5.6 per 1,000, or 40 percent, caused the patient to go to bed or enter a hospital for one or more days. Considering all ages, the total case rate for females is 182 percent in excess of that for males and the bed case rate is 139 percent in excess. However, the number of bed days per 1,000 females is only 15 percent above this rate for males because the average bed days per bed case for females is 52 percent less than for males. In other words, females reported many cases, but they were of short duration, whereas the fewer cases for males were of long duration. The large number of short cases for women suggests the possibility that some menstrual and other female genital disorders may have been reported under such diagnoses as nervousness. Serious mental diseases that involve institutional care are definitely more frequent among men than women at every age group above 15 years, according to data on admissions to mental hospitals in Massachusetts, New York, and Illinois during the years 1929–31 (*17*).

[26] A total of 16 cases of all diagnoses was recorded as being in a hospital throughout the year of the study, a rate of 0.45 such cases with 163 hospital days per 1,000 persons included in the survey (rate adjusted for age by an indirect method). Of the 16 cases, 6 were nervous and mental, 8 tuberculous, and 2 orthopedic, of which 1 was of congenital origin and was complicated by mental defect.

The relative age curves of bed cases are similar to those for total cases of nervous and mental diseases, but the curves for days in bed per 1,000 population are quite different; chance variation is considerable, but the peaks in the young adult and middle ages are probably significant, being due to long durations per case at these ages.

The female genital [27] diseases occur largely in the same ages as puerperal conditions, so they are considered in one group. Aside from short durations for female genital diseases in childhood, the bed days per case for the group are approximately the same for all ages. Childbirth constitutes about half of the total cases in the class.

Total accidental injuries, and also those confining the patient to bed, do not vary greatly with age among females except for a definite increase among persons over 65 years. Among males there are suggestions of two peaks, one at the school ages, 5–14 years, and one at about 40 years which may be associated with industrial work. There is little or no rise in the frequency of accidents among males of the older ages, but among both males and females there is a definitely longer period in bed per bed case for patients over 65 years of age, resulting in a large increase in bed days per 1,000 population.

Injuries are definitely less frequent among females than males at all except the two oldest age periods. For total cases, the rate for females of all ages is 36 percent less than the rate for males; for bed cases, the female rate is 26 percent less and for bed days per 1,000 it is 18 percent less than for males. However, bed days per case was 10 percent greater for females than males.

Rheumatic diseases include the various joint, muscle, and nerve pains and irritations; that is, rheumatism, arthritis, neuritis, neuralgia, lumbago, myalgia, and myositis. Of the total rate of 25.8 cases per 1,000, 10.2 per 1,000, or 40 percent of the cases, were confined to bed for one or more days. The total case rate among females of all ages is 36 percent above that among males, and the female rate for bed cases is 23 percent above that for males; number of bed days per 1,000 is 44 percent higher, and bed days per case 17 percent higher for females than males. The frequency of cases of this rheumatic group, both total and in bed, increases definitely with age.

The degenerative diseases include those of the heart, kidney (except pyelitis), bladder, prostate, and arteries, cerebral hemorrhage and paralysis, benign tumor (except of the female genital organs), cancer, and diabetes. Although the prostate refers to males only, the diseases of this organ are so definitely of the old age or degenerative type that they are included in this group; the numbers are small and their only effect is to bring the rates for males nearer those for females at ages

[27] Mention has already been made of the possibility that some menstrual and other female genital disorders may have been reported as nervousness The excess of illness in the "all other" class (see tables 7-12) for adult and middle-aged women suggests the possibility that some of these conditions may have been reported under ill-defined or other diagnoses included in this miscellaneous class.

over 65 years. The rates for degenerative diseases, both incidence and days in bed per 1,000, are rather consistently higher for females than males. At all ages, the rate for total cases is 49 percent higher for females than males; for bed case incidence, the female excess is 52 percent, and for bed days per 1,000 the rate for females is 57 percent above that for males. Bed days per case is only 3 percent higher for females than males; thus nearly all of the excess in bed days per 1,000 for females is due to more bed cases rather than to longer durations in bed per case. All three types of rates rise more sharply with age for the degenerative diseases than for any of the other diagnosis groups. However, the average days in bed per case does not vary greatly with age.

To summarize, in 6 of the 12 diagnosis groups common to both sexes the relative excess in the rate for females over that for males is least for all cases (including nondisabling and nonbed cases), greater (or the same) for bed cases per 1,000, and greatest for bed days per 1,000. These 6 groups are minor and other respiratory, minor and other digestive, communicable, and degenerative diseases. In two other diagnoses (ear and rheumatic diseases), the tendency is in the same direction although the figures are irregular. In two of the remaining four diagnoses (skin diseases and "all other"), the figures are irregular, but the female excess is less for either or both the bed day and bed case rate than it is for the total rate. The nervous diseases, which show by far the largest female excesses, are strikingly different in that the excess is much greater for total cases than it is for bed cases and is still less for bed days per 1,000. All of the rates for accidents are less for females than males, the deficiency being greater in total cases than in bed cases or bed days. All except one of the 12 diagnosis groups show lower death rates for females than males, the exception, rheumatic diseases, having a small death rate. Thus, as in the rates for all causes combined, the indications are fairly clear that there are more bed cases and bed days per 1,000 women than men, and it is equally clear that the mortality is less for women than men.

The fact that all causes combined or even that broad cause groups show consistently higher sickness rates and consistently lower death rates for females than males does not mean that there are not exceptions to these relationships. The cases of illness in this study were classified into 71 diagnosis classes common to the two sexes [28] and for which death data for the registration States could also be secured. Of these 71 specific diagnoses, 28 had sickness rates for females that were lower than those for males, the other 43 showing rates that were equal to or higher for females than males. Of the 71 diagnoses, 14 had death rates for females that were equal to or greater than those for males, the other 57 having lower death rates for females than males. To

[28] Excludes male genital, female genital and puerperal diagnoses.

carry the analysis further, of the 71 specific diagnoses, 33 showed sickness rates that were higher and death rates that were lower for females than males; 24 diagnoses showed sickness and death rates both lower for females than males; 10 diagnoses showed sickness and death rates both higher for females than males; and 4 diagnoses showed sickness rates that were lower and death rates that were higher for females than males. The above statements are based on observed rates without regard to chance variation.

IV. SUMMARY

Data on the frequency and duration of illness from specific causes were recorded for a 12-month period between 1928 and 1931 by periodic canvasses of 8,758 white families in 130 localities in 18 States. The visits were made at intervals of 2 to 4 months. Illnesses causing symptoms that lasted for 1 day or longer within the study year were recorded and data are shown separately for those that confined the patient to bed for 1 day or longer and also those that caused inability to work or pursue other usual activities (disability) for 1 day or longer.

The surveyed families include representation from nearly all geographic sections, from rural, urban, and metropolitan areas, from all income classes, and of both native- and foreign-born persons.

The recorded illness from all causes amounted to a total of 823 cases per 1,000 persons, causing 29 days of sickness (disabling and nondisabling) per person under observation.

Of the total cases, 60 percent, or 492 per 1,000 persons under observation, were disabling for 1 or more days; of the total days of sickness (disabling and nondisabling), 26 percent were disabling, or 7.7 days of disability per person under observation. For various reasons this figure of disability is considered a minimum statement.

Days in bed on account of sickness were recorded for each illness. Fifty percent of the total cases caused the patient to go to bed for 1 or more days, a rate of 414 bed cases per 1,000 persons under observation; of the total sick days (bed and nonbed), only 13 percent were spent in bed, a rate of 3.9 days in bed per person under observation. Of the cases that disabled for 1 or more days, 84 percent were in bed for 1 or more days, but of the disabled days only 51 percent were spent in bed.

There were about 74 illnesses for each death; bed illnesses amounted to about 37 for each death registered.

According to the various measures of illness, there is more sickness in childhood than in youth; the lowest rates occur at 15–19 and 20–24 years of age for females and males, respectively. After the minimum there is some rise in nearly every type of illness rate. The various case rates show only slight or moderate increases with age, but the rates expressed in days per 1,000 rise more rapidly with age, particu-

larly for persons over 65 years old. The variation with age is far greater in mortality rates than in any of the several measures of sickness; the minimum mortality occurs at 10–14 years in both of the sexes, followed by a sharp rise with age (fig. 1).

The various measures of illness show consistently higher rates for females than males, even when female genital and puerperal diagnoses have been eliminated so that the two sexes are compared with respect to diseases that are common to both. The only exception to this relationship is in disabled days per 1,000, in which the rates (exclusive of genital and puerperal) are about the same for the two sexes.

When the relative differences between the sexes are considered for persons of all ages, females show a larger percentage excess over males in bed illness, both cases and days, than they do in the total of all illnesses including minor nondisabling and nonbed cases; this refers to diagnoses common to the two sexes. The excess in illness of females over males is true of those who are gainfully occupied as well as of the total canvassed population. In mortality, on the other hand, females show definitely lower death rates than do males of the same ages.

The minor respiratory diseases are extremely important in sickness, causing 34 percent of the total cases and 39 percent of the cases that confined the patient to bed for 1 or more days. In terms of days of sickness, however, they are second to the degenerative or old-age diseases which account for 19 percent of all sick days (disabling and nondisabling) as compared with 10 percent for the minor respiratory diseases. Of the total days in bed, the minor respiratory diseases caused 19 percent and the degenerative diseases 16 percent. However, the major respiratory diseases accounted for an additional 13 percent of the days in bed (fig. 4).

The various kinds of rates including total, disabling, and bed cases per 1,000, and total, disabled, and bed days per 1,000 population are shown by age and sex for each of 13 diagnosis groups. In practically all of these diagnosis groups the illness rates for females are considerably in excess of those for males. As a rule the excess for bed cases and bed days is even greater than for total cases and days which include the minor nondisabling and nonbed cases and days. In studies of industrial workers where records of illness are kept currently and thus are more accurate than reports of surveyed families, women have also been found to have considerably more sickness than men.

Mortality in these various diagnosis groups is almost uniformly higher for men than women. Recent data on occupational mortality in England and Wales indicate that among men and women engaged in the same specific occupation the death rates are usually lower for women.

When specific diseases are considered as causes of death, it is found that there are a considerable number in which mortality is higher for women than men, but in the great majority the reverse is true. Similarly, in illness there are a number of specific diseases in which the rates are lower for women than men, but the reverse is usually the case.

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VI. APPENDIX

TABLE 7.—*Total*[1] *illnesses from certain causes per 1,000 population of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole or primary diagnoses only]

Sex and diagnosis[2] group with International List numbers, 1920 revision	All ages[3]: Number of cases	All ages[3]: Adjusted[4]	All ages[3]: Crude	Age[5]: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Total cases[3] (disabling and nondisabling) per 1,000 population during year											
Minor respiratory diseases (11, pt. 97, 98, 99, pt. 107, pt. 109):													
Both sexes	11, 336	277.5	294.1	476.1	342.4	246.7	209.2	212.8	265.8	256.2	245 9	266.8	265.5
Male	5, 283	256.9	279.6	491.8	335.5	239.9	198.4	168.9	240.2	226.3	215.7	236.3	226.5
Female	6, 050	296.9	308.3	462.4	349.2	253.6	220.0	244.9	284.7	286.3	282.9	303.4	295.9
Other respiratory diseases (31, pt. 97, 100–106, pt. 107, pt. 109):													
Both sexes	2, 091	51.0	54.3	59.9	81.7	55.6	44.8	50.5	51.2	46.2	37.6	40.1	37.1
Male	997	49.2	52.8	61.6	85.5	51.7	43.9	47.0	46.6	43.0	35.2	44.8	27.5
Female	1, 092	52.4	55.6	57.7	78.1	59.5	44.7	53.1	54.7	49.5	40.5	34.4	44.6
Minor digestive diseases (15, pt. 16, 112–114):													
Both sexes	2, 323	57.1	60.3	136.8	53.7	34.8	30.5	32.6	43.1	50.9	57.0	72.6	87.3
Male	1, 071	52.2	56.7	132.5	53.9	36.1	19.0	25.7	39.1	44.7	50.4	65.9	82.4
Female	1, 252	62.1	63.8	142.3	53.5	33.5	42.0	37.5	46.0	57.3	66.4	80.7	90.9
Other digestive diseases (pt. 108, 110, 111, 115–127):													
Both sexes	1, 031	28.9	26.7	19.6	15.6	16.2	24.3	32.6	34.2	34.1	36.1	36.0	40.1
Male	421	23.8	22.3	17.8	15.3	15.7	17.7	23.5	34.5	23.8	31.4	21.1	32.0
Female	610	34.0	31.1	21.6	15.9	16.8	30.9	39.2	34.0	44.4	41.8	53.8	46.3
Communicable diseases (1–10, 12–14, pt. 16, 17–30, 32–42):													
Both sexes	3, 671	71.4	95.2	235.6	241.3	97.2	40.0	22.2	26.8	21.9	18.8	12.9	10.0
Male	1, 801	69.9	95.3	230.4	242.9	96.0	42.6	20.1	24.1	16.8	22.8	11.2	4.6
Female	1, 870	72.8	95.3	242.9	239.7	98.4	37.4	23.7	28.7	27.1	13.9	14.9	14.3
Ear and mastoid diseases (86):													
Both sexes	723	16.3	18.8	41.2	28.3	17.3	13.4	9.9	11.2	10.5	9.9	15.6	10.0
Male	359	16.4	19.0	44.9	26.6	18.7	13.7	8.9	10.0	9.1	7.1	19.9	13.7
Female	364	16.2	18.5	37.6	30.1	15.9	13.1	10.6	12.0	11.9	13.3	10.5	7.1

See footnotes at end of table.

TABLE 7.—*Total illnesses from certain causes per 1,000 population of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*—Continued

Sex and diagnosis group with International List numbers, 1920 revision	All ages: Number of cases	All ages: Adjusted	All ages: Crude	Age: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Total cases (disabling and nondisabling) per 1,000 population during year											
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis (70–73, 76–81, 84):													
Both sexes	499	14.1	12.9	8.5	6.5	6.8	10.5	12.7	19.1	17.0	18.8	21.7	18.0
Male	138	7.3	7.3	10.0	6.4	6.1	8.5	1.1	5.4	6.0	8.1	12.4	13.7
Female	361	20.6	18.4	7.1	6.6	7.5	12.5	21.2	29.3	28.1	31.9	32.9	21.4
Rheumatism and related diseases (51, 52, 82, pt. 158):													
Both sexes	797	25.8	20.7	.4	4.0	3.9	4.3	4.7	25.3	36.8	52.8	80.8	61.1
Male	340	21.9	18.0	.4	5.0	3.9	3.9	2.2	19.6	32.9	44.4	69.7	50.3
Female	457	29.7	23.3	.4	3.1	4.0	4.6	6.5	29.7	40.7	63.1	94.2	69.5
Degenerative diseases (43–50, 57, 74, 75, 83, 87–92, pt. 93, pt. 96, 128, 129, 130, pt. 131, 132, pt. 133, 135):													
Both sexes	1,218	43.0	31.6	7.6	10.7	9.9	14.1	12.7	20.9	41.8	61.8	101.8	239.5
Male	458	34.6	24.2	7.5	10.3	8.7	9.8	7.8	15.0	27.9	40.1	82.1	242.6
Female	760	51.7	38.7	7.8	11.1	11.0	18.4	16.3	35.8	55.9	88.3	125.6	237.1
Skin diseases (151–154, pt. 205):													
Both sexes	1,341	33.2	34.8	42.1	40.9	42.9	47.5	27.8	28.0	26.5	28.7	21.7	27.1
Male	650	32.3	34.4	42.7	40.1	40.0	48.5	26.9	30.8	20.9	27.1	14.9	20.6
Female	690	34.2	35.2	41.4	41.8	45.9	46.6	28.6	25.9	26.1	30.5	29.9	32.1
Female genital, and puerperal diagnoses (137–150):													
Both sexes	1,540	44.8	39.9	1.1	.7	2.9	24.3	119.4	129.4	62.6	21.5	6.1	5.0
Female	1,540	82.3	78.5	2.2	1.4	5.7	48.6	206.5	8225.	5125.	747.8	13.5	8.9
Accidental injuries (pt. 85, 165–203):													
Both sexes	2,880	73.7	74.7	70.7	85.9	85.8	81.0	64.2	65.4	74.0	66.3	65.9	84.2
Male	1,768	90.4	93.6	83.7	115.3	115.6	110.0	91.7	82.0	91.0	74.3	63.4	66.4
Female	1,112	57.9	56.7	57.7	57.3	55.6	51.9	44.1	53.1	56.9	56.4	68.8	98.0
All other diseases (53–56, 58–69, pt. 85, pt. 93, 94, 95, pt. 96, pt. 108, pt. 131, pt. 133, 134, 136, 155–157, pt. 158, 159–164, 204, pt. 205):													
Both sexes	3,302	85.8	85.7	111.7	66.3	59.1	56.4	70.3	93.4	95.1	104.5	102.5	94.2
Male	1,310	65.5	69.3	116.5	63.5	51.7	45.8	30.2	62.9	68.5	68.8	80.9	70.9
Female	1,988	104.7	101.3	106.2	69.1	66.6	67.0	99.6	116.1	122.0	148.1	128.5	112.3

[1] Including both disabling and nondisabling cases whose symptoms lasted for 1 or more days.

[2] For the relative frequency of specific causes included in each broad group see preceding papers (*6*, fig. 1 and table 1, and *1*, table 12). The communicable, ear, skin, accident, and female genital and puerperal groups in this study are identical with the groups used in those studies; of the respiratory group, coryza and colds, bronchitis and chest colds, tonsillitis, sore throat, and other diseases of the pharynx and larynx, and influenza and grippe are classified as minor respiratory, other respiratory diseases including tonsillectomy and respiratory tuberculosis being in the other (major) respiratory group; of the digestive group, indigestion, upset stomach, nausea, biliousness, other stomach, and diarrhea and enteritis are classified as minor digestive; degenerative include diseases of the heart, arteries, bladder, prostate, kidney (except pyelitis), and cancer, benign tumor (except of the female genital organs), diabetes, cerebral hemorrhage and paralysis; rheumatic diseases include rheumatism (acute and chronic), neuralgia and neuritis, lumbago, myalgia and myositis; nervous diseases include neurasthenia, nervous breakdown, nervousness, insanity and mental cases of all types, and other diseases of the nervous system except neuralgia and neuritis and cerebral hemorrhage and paralysis. A forthcoming paper will show in more detail the incidence and durations of the specific causes included in each broad group used in the present paper.

[3] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

[4] Rates in the form of cases or days per 1,000 population are adjusted by the direct method to the age distribution of the white population of the death registration States in 1930 as a standard population; this population is given for specific ages in table 1 of a preceding paper (*4*). The adjustment method involves the weighting of the age specific rates for the canvassed population according to the age distribution of the standard population. The details of the process are given under the heading of "corrected death rates" in Pearl (*23*), pp. 269–271.

[5] Cases represent periods of illness classified according to the primary cause (for details about classification of causes see a preceding paper (*1*)). Cases include those with prior onset that extended into the study year and those still sick at the last visit.

[6] Rates plotted in fig. 5 as 45–64: Other respiratory, male 38.1, female 38.6; ear and mastoid, male 10.9, female 12.4.

TABLE 8.—*Disabling*[1] *illnesses from certain causes per 1,000 population of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole or primary diagnoses only]

Sex and diagnosis[2] group	All ages[3]			Age									
	Number of cases	Adjusted[4]	Crude	Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Disabling cases[5] per 1,000 population during year											
Minor respiratory diseases:													
Both sexes	7,587	183.6	196.8	284.2	266.8	199.4	150.2	144.9	169.0	162.4	152.2	153.4	153.8
Male	3,593	174.4	190.1	294.2	258.2	196.9	137.5	123.0	163.2	146.4	136.6	140.3	139.6
Female	3,991	192.4	203.3	275.0	275.3	202.0	162.8	160.8	173.3	178.6	171.3	158.4	164.0
Other respiratory diseases:													
Both sexes	1,607	37.7	41.7	54.8	75.2	44.0	32.1	38.2	32.6	28.0	23.0	24.4	25.1
Male	778	36.9	41.2	54.5	79.8	40.0	30.1	34.7	30.4	28.9	20.6	31.1	18.3
Female	827	38.3	42.1	54.8	70.8	48.1	34.1	40.8	34.3	27.1	25.9	16.4	30.3
Minor digestive diseases:													
Both sexes	1,303	31.5	33.8	70.9	38.8	27.6	21.3	18.4	22.3	22.8	27.5	33.9	50.1
Male	581	27.7	30.7	67.3	36.2	26.5	14.4	16.8	20.0	21.8	21.7	27.4	36.6
Female	722	35.4	36.8	75.3	41.5	28.7	28.2	19.6	24.1	23.7	34.5	41.9	60.6
Other digestive diseases:													
Both sexes	679	19.4	17.6	6.0	12.1	14.0	19.0	25.0	24.3	21.8	20.6	24.4	27.1
Male	282	16.1	14.9	6.8	11.7	13.5	13.1	20.1	25.0	16.4	17.3	13.7	18.3
Female	397	22.7	20.2	5.2	12.4	14.6	25.0	28.6	23.8	27.1	24.6	37.4	33.9
Communicable diseases:													
Both sexes	2,826	55.3	73.3	144.4	212.1	87.6	33.1	14.2	21.3	16.4	13.4	10.2	6.0
Male	1,393	54.4	73.7	141.7	213.5	88.2	32.1	12.3	19.6	13.8	17.3	10.0	-----
Female	1,433	56.0	73.0	148.3	210.7	86.9	34.1	15.5	22.5	19.0	8.6	10.5	10.7
Ear and mastoid diseases:													
Both sexes	366	7.6	9.5	20.9	21.2	9.2	8.2	4.2	3.5	3.7	2.4	1.4	2.0
Male	178	7.3	9.4	21.4	21.3	9.1	7.2	2.2	2.5	4.4	1.1	1.2	4.6
Female	188	7.9	9.6	20.5	21.1	9.3	9.2	5.7	4.3	3.0	4.0	1.5	-----
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis:													
Both sexes	241	6.7	6.3	5.3	3.5	3.7	5.2	5.2	8.0	7.9	8.7	12.2	8.0
Male	82	4.3	4.3	5.7	3.9	4.3	5.9	1.1	2.5	3.4	4.9	7.5	6.9
Female	159	9.1	8.1	4.8	3.1	3.1	4.6	8.2	12.0	12.5	13.3	17.9	8.9
Rheumatism and related diseases:													
Both sexes	403	12.7	10.5	.2	3.5	3.3	1.6	3.3	11.9	17.9	28.6	34.6	29.1
Male	197	12.3	10.4	------	4.3	3.5	2.0	2.2	8.3	19.5	30.4	29.9	29.7
Female	206	13.0	10.5	.4	2.8	3.1	1.3	4.1	14.5	16.3	26.6	40.4	28.5
Degenerative diseases:													
Both sexes	633	23.7	16.4	2.9	4.9	4.4	7.5	7.6	12.1	20.4	29.8	54.3	160.3
Male	245	19.6	13.0	3.2	4.6	4.3	3.3	5.6	5.8	15.1	20.1	44.8	160.2
Female	358	27.8	19.8	2.6	5.2	4.4	11.8	9.0	16.7	25.8	41.8	65.8	160.4
Skin diseases:													
Both sexes	381	9.5	9.9	8.2	13.1	15.1	15.4	7.1	8.3	6.6	7.2	6.1	9.0
Male	196	10.2	10.4	8.5	12.8	10.4	17.7	8.9	10.8	8.4	8.7	6.2	9.2
Female	185	8.9	9.4	7.8	13.5	19.9	13.1	5.7	6.5	4.7	5.3	6.0	8.9
Female genital and puerperal diagnoses:													
Both sexes	1,241	36.3	32.2	.5	-----	1.8	17.0	105.2	108.7	.48.4	13.1	3.4	4.0
Female	1,241	66.3	63.2	1.1	-----	3.5	34.1	182.0	189.3	97.3	29.2	7.5	7.1
Accidental injuries:													
Both sexes	1,387	36.9	36.0	17.2	40.4	43.6	41.0	35.9	.35.5	40.0	34.6	38.7	44.1
Male	881	47.3	46.6	19.9	52.1	57.4	59.6	54.8	49.5	58.0	41.2	39.8	34.3
Female	506	27.2	25.8	14.5	29.0	29.6	22.3	22.0	25.0	26.8	26.6	37.4	51.7
All other diseases:													
Both sexes	1,233	30.5	32.0	48.4	33.1	27.6	20.3	21.2	30.7	31.0	32.2	28.5	31.1
Male	521	24.5	27.6	54.8	33.3	23.9	13.8	10.1	20.4	22.2	22.8	27.4	18.3
Female	708	35.9	36.1	40.6	32.8	31.3	26.9	29.4	38.3	40.0	43.8	29.9	41.0

[1] Disability refers to inability to work, attend school, care for home, or pursue other usual activities for 1 or more days, regardless of employment status and age.

[2] For details about inclusions in the diagnosis groups and International List numbers, see table 7.

[3] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

[4] Adjusted by the direct method as described in footnote to table 7.

[5] Cases represent periods of disability classified according to the primary cause (for details about classification of causes, see a preceding paper (*1*)). Cases include those with prior onset that extended into the study year and those still sick at the last visit.

TABLE 9.—*Bed illnesses [1] from certain causes per 1,000 population of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole or primary diagnoses only]

Sex and diagnosis [2] group	All ages [3]: Number of cases	All ages [3]: Adjusted [4]	All ages [3]: Crude	Age [6]: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Bed cases [5] per 1,000 population during year											
Minor respiratory diseases:													
Both sexes	6,691	162.1	173.6	267.5	221.5	164.2	125.3	128.8	152.8	146.9	139.1	131.0	141.3
Male	3,103	149.7	164.2	276.0	214.9	158.6	115.9	107.4	141.5	124.9	120.9	118.2	116.7
Female	3,585	173.8	182.7	259.7	228.0	169.8	134.6	144.5	161.2	169.1	161.3	146.5	160.4
Other respiratory diseases:													
Both sexes	1,508	35.0	39.1	54.2	72.6	41.6	28.9	32.6	29.8	24.6	20.6	21.7	25.1
Male	723	33.7	38.3	53.8	76.6	37.4	27.5	26.9	27.5	25.5	16.8	27.4	18.3
Female	783	36.0	39.9	54.4	68.7	45.9	30.2	36.7	31.5	23.7	25.2	14.9	30.3
Minor digestive diseases:													
Both sexes	1,139	27.4	29.5	65.5	33.4	23.6	19.0	15.1	18.6	18.9	23.0	29.2	46.1
Male	482	22.6	25.5	60.2	31.2	21.3	12.4	12.3	15.0	16.5	15.7	21.1	32.0
Female	657	32.3	33.5	71.5	35.6	26.0	25.6	17.1	21.3	21.3	31.9	38.9	57.0
Other digestive diseases:													
Both sexes	621	17.7	16.1	5.3	10.5	13.6	18.0	24.1	22.5	19.7	18.2	20.4	25.1
Male	248	14.1	13.1	6.4	10.3	13.0	11.8	19.0	21.2	14.1	14.1	11.2	16.0
Female	373	21.3	19.0	4.1	10.7	14.1	24.3	27.8	23.5	25.4	23.2	31.4	32.1
Communicable diseases:													
Both sexes	2,241	43.9	58.1	126.3	154.9	69.8	25.6	12.7	17.0	13.7	11.3	8.1	6.0
Male	1,096	42.6	58.0	123.6	156.7	70.0	23.6	8.9	15.0	10.7	14.6	7.5	----
Female	1,145	45.1	58.3	130.0	153.0	69.7	27.6	15.5	18.5	16.6	7.3	9.0	10.7
Ear and mastoid diseases:													
Both sexes	281	5.8	7.3	18.5	14.3	6.3	5.3	4.3	3.0	3.0	1.8	.7	1.0
Male	139	5.5	7.4	19.6	14.2	7.8	5.2	2.2	1.7	3.7	----	----	2.8
Female	142	6.0	7.2	17.5	14.5	4.9	5.3	5.7	4.0	2.4	4.0	1.5	----
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia and neuritis:													
Both sexes	201	5.6	5.2	4.9	2.3	2.9	4.6	3.8	7.3	6.6	6.9	10.2	8.0
Male	63	3.3	3.8	5.7	2.8	2.6	4.6	1.1	1.7	2.3	2.7	6.2	6.9
Female	138	7.9	7.0	4.1	1.7	3.1	4.6	4.9	11.4	10.8	11.9	14.9	8.9
Rheumatism and related diseases:													
Both sexes	326	10.2	8.5	.2	3.3	2.6	1.6	2.8	10.6	14.5	21.5	23.8	26.1
Male	147	9.1	7.8	----	4.3	3.0	2.0	1.1	5.8	14.8	21.7	18.7	25.2
Female	179	11.2	9.1	.4	2.4	2.2	1.3	4.1	14.2	14.2	21.3	29.9	26.7
Degenerative diseases:													
Both sexes	541	20.5	14.0	2.5	3.0	3.9	5.3	6.1	11.0	17.5	25.4	43.5	147.3
Male	198	16.2	10.5	2.5	2.1	3.9	.7	3.4	5.4	12.8	16.3	36.1	139.6
Female	343	24.7	17.5	2.6	3.8	4.0	9.9	8.2	15.1	22.4	36.5	52.3	153.3
Skin diseases:													
Both sexes	176	4.5	4.6	6.2	3.7	3.7	6.9	2.8	5.0	3.9	4.5	2.0	6.0
Male	91	4.6	4.8	6.1	4.3	3.9	6.5	2.2	6.2	4.7	4.9	----	4.6
Female	85	4.4	4.3	6.3	3.1	3.5	7.2	3.3	4.0	3.1	4.0	4.5	7.1
Female genital and puerperal diagnoses:													
Both sexes	1,217	35.6	31.6	.2	----	1.5	15.7	102.9	108.0	47.4	12.5	3.4	4.0
Female	1,217	64.9	62.0	.4	----	3.1	31.5	178.0	188.1	95.2	27.9	7.5	7.1
Accidental injuries:													
Both sexes	866	23.1	22.5	14.5	24.1	25.0	20.7	22.2	21.5	25.8	21.8	24.4	35.1
Male	505	26.6	26.7	16.7	30.5	31.7	29.5	28.0	26.6	29.9	22.8	22.4	25.2
Female	361	19.7	18.4	12.3	18.0	18.1	11.8	18.0	17.6	21.7	20.6	26.9	42.8
All other diseases:													
Both sexes	920	23.0	23.9	43.0	18.7	13.6	11.1	15.6	24.3	25.6	27.5	23.8	26.1
Male	365	16.8	19.3	49.5	19.1	10.9	8.5	7.8	10.8	15.4	17.9	19.9	11.4
Female	551	28.5	28.1	35.0	18.3	16.3	13.8	21.2	34.3	35.9	39.2	28.4	37.4

[1] Including all cases in which the patient was in bed for 1 or more days; all hospital cases are counted as bed cases.

[2] For details about inclusions in the diagnosis groups and International List numbers, see table 7.

[3] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

[4] Adjusted by the *direct* method as described in footnote to table 7.

[5] Cases represent periods in bed classified according to the primary cause (for details about classification of causes, see a preceding paper (*1*)). Cases include those with prior onset that extended into the study and those still sick at the last visit.

[6] Rates plotted in fig. 5 as 45–64: Other respiratory, male 20.0, female 22.1; skin, male 3.4, female 4.1. Rates plotted as 45 and over: Ear and mastoid, male 0.3, female 2.6.

TABLE 10.—*Days sick*[1] *from certain causes per 1,000 population of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole or primary diagnoses only]

Sex and diagnosis[2] group	All ages[3]			Age									
	Number of days	Adjusted[4]	Crude	Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Annual sick days[5] (disabled and nondisabled) per 1,000 population											
Minor respiratory diseases:													
Both sexes	115, 213	3, 001	2, 989	4, 330	2, 994	2, 072	1, 890	2, 126	2, 807	2, 736	3, 355	4, 138	4, 650
Male	52, 549	2, 674	2, 781	4, 561	3, 050	2, 056	1, 752	1, 591	2, 481	2, 183	2, 846	3, 907	3, 055
Female	62, 644	3, 300	3, 192	4, 116	2, 940	2, 089	2, 029	2, 518	3, 050	3, 294	3, 979	4, 416	5, 893
Other respiratory diseases:													
Both sexes	94, 425	2, 600	2, 450	1, 067	2, 415	2, 082	1, 942	2, 836	2, 882	3, 250	2, 549	3, 673	3, 811
Male	40, 514	2, 309	2, 144	1, 356	1, 967	1, 677	1, 946	2, 302	2, 292	2, 504	2, 607	3, 873	3, 119
Female	53, 877	2, 846	2, 745	760	2, 852	2, 494	1, 937	3, 225	3, 320	4, 002	2, 479	3, 433	3, 460
Minor digestive diseases:													
Both sexes	39, 825	1, 214	1, 033	1, 304	351	259	273	381	861	1, 346	1, 817	3, 728	3, 275
Male	16, 530	989	875	1, 178	262	158	100	185	734	1, 119	1, 732	2, 896	2, 561
Female	23, 295	1, 436	1, 187	1, 446	438	361	447	524	956	1, 575	1, 920	4, 728	3, 831
Other digestive diseases:													
Both sexes	65, 143	1, 993	1, 690	735	512	672	815	1, 788	2, 319	2, 216	3, 464	3, 946	4, 354
Male	30, 326	1, 899	1, 605	898	429	700	894	1, 180	3, 067	1, 823	2, 922	2, 408	5, 261
Female	34, 817	2, 151	1, 774	570	593	644	737	2, 232	1, 765	2, 612	4, 127	5, 795	3, 647
Communicable diseases:													
Both sexes	85, 628	1, 742	2, 222	5, 309	4, 867	2, 160	720	961	885	947	782	436	450
Male	41, 877	1, 721	2, 216	5, 175	5, 088	1, 952	861	760	833	663	893	639	732
Female	43, 751	1, 759	2, 229	5, 491	4, 652	2, 382	580	1, 108	924	1, 233	645	191	230
Ear and mastoid diseases:													
Both sexes	18, 377	474	477	805	550	370	507	398	390	322	243	346	1, 251
Male	9, 664	534	511	856	578	552	793	423	252	265	70	392	2, 135
Female	8, 713	424	444	758	523	185	221	380	491	381	454	291	561
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia neuritis:													
Both sexes	47, 756	1, 366	1, 239	627	640	1, 177	1, 484	960	1, 088	1, 626	2, 165	2, 175	2, 122
Male	17, 688	943	936	736	743	898	1, 528	4	502	899	1, 524	2, 127	892
Female	30, 068	1, 746	1, 532	516	539	1, 470	1, 439	1, 658	1, 523	2, 361	2, 951	2, 233	3, 080
Rheumatism and related diseases:													
Both sexes	56, 108	1, 996	1, 456	32	142	162	102	337	1, 244	2, 432	3, 222	8, 520	7, 401
Male	23, 490	1, 597	1, 243	12	167	160	158	72	860	2, 263	2, 984	7, 219	2, 479
Female	32, 618	2, 359	1, 662	53	116	164	45	531	1, 528	2, 602	3, 513	10, 084	9, 832
Degenerative diseases:													
Both sexes	145, 553	5, 475	3, 776	482	914	1, 115	1, 815	821	2, 347	4, 157	8, 943	15, 662	33, 774
Male	51, 448	4, 003	2, 723	292	848	1, 004	1, 453	465	994	2, 667	5, 886	11, 892	27, 515
Female	94, 105	6, 939	4, 795	685	979	1, 136	2, 178	1, 081	3, 351	5, 660	12, 689	20, 193	38, 649
Skin diseases:													
Both sexes	52, 105	1, 326	1, 352	1, 887	1, 030	1, 404	1, 842	904	1, 300	1, 179	1, 289	1, 196	1, 205
Male	23, 422	1, 207	1, 240	1, 895	815	1, 364	1, 895	846	1, 157	941	1, 135	874	1, 311
Female	28, 062	1, 447	1, 460	1, 886	1, 238	1, 445	1, 789	1, 051	1, 406	1, 419	1, 478	1, 583	1, 123
Female genital and puerperal diagnoses:													
Both sexes	65, 433	1, 887	1, 698	15	11	130	539	3, 403	4, 846	3, 224	2, 123	819	642
Female	65, 433	3, 562	3, 334	31	22	262	1, 119	5, 880	3, 441	6, 478	4, 723	1, 804	1, 143
Accidental injuries:													
Both sexes	54, 218	1, 518	1, 407	830	1, 266	1, 363	1, 406	1, 448	1, 427	1, 560	1, 480	1, 788	3, 453
Male	32, 191	1, 750	1, 704	1, 053	1, 838	1, 788	1, 684	2, 180	1, 622	1, 950	1, 714	1, 800	1, 954
Female	22, 027	1, 285	1, 122	603	709	931	1, 128	913	1, 282	1, 167	1, 193	1, 774	4, 620
All other diseases:													
Both sexes	173, 717	4, 811	4, 507	3, 983	2, 744	3, 371	3, 117	4, 148	5, 154	5, 124	6, 866	6, 584	8, 081
Male	64, 348	3, 591	3, 405	3, 577	2, 544	2, 580	2, 052	2, 398	3, 020	3, 788	4, 928	4, 699	8, 522
Female	109, 169	5, 986	5, 562	4, 364	2, 939	4, 174	4, 185	5, 424	6, 736	6, 474	9, 240	8, 849	7, 738

[1] Including both disabled and nondisabled days on account of illness whose symptoms lasted for 1 or more days.

[2] For details about inclusions in the diagnosis groups and International List numbers, see table 7.

[3] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

[4] Adjusted by the direct method as described in footnote to table 7.

[5] Days refer to those within the study year only but on both complete and incomplete cases; in computing days, cases with unknown durations of symptoms were put in at an average based on cases of the same diagnosis group with known duration, exclusive of the cases that lasted throughout the year of observation.

TABLE 11.—*Days of disability [1] from certain causes per 1,000 population of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole or primary diagnoses only]

Sex and diagnosis [2] group	All ages [3]			Age									
	Number of days	Adjusted [4]	Crude	Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Annual days of disability [5] per 1,000 population											
Minor respiratory diseases:													
Both sexes	52,498	1,305	1,362	1,973	1,779	1,175	970	981	1,256	1,084	1,186	1,275	1,604
Male	25,255	1,247	1,336	2,108	1,802	1,142	849	859	1,326	999	1,009	1,261	1,143
Female	27,215	1,362	1,387	1,837	1,756	1,208	1,090	1,070	1,204	1,170	1,403	1,292	1,963
Other respiratory diseases:													
Both sexes	35,514	944	921	521	1,257	937	840	1,296	1,107	723	845	978	966
Male	18,067	965	936	570	1,324	875	977	870	1,123	933	817	1,558	442
Female	17,432	898	888	468	1,191	1,000	702	1,607	1,096	512	878	280	1,374
Minor digestive diseases:													
Both sexes	7,939	221	206	458	144	117	102	85	103	158	126	377	1,004
Male	3,228	169	171	441	135	93	51	58	99	102	74	403	518
Female	4,711	268	240	479	153	141	154	104	106	216	190	345	1,383
Other digestive diseases:													
Both sexes	15,900	481	413	63	181	280	381	553	696	515	490	632	1,191
Male	7,482	471	396	109	151	273	263	426	865	457	488	562	1,165
Female	8,418	496	429	16	209	286	499	646	571	573	492	716	1,211
Communicable diseases:													
Both sexes	50,730	986	1,316	2,809	3,571	1,576	434	253	349	454	234	125	102
Male	25,561	997	1,353	3,032	3,533	1,360	448	279	415	421	333	149	------
Female	25,169	975	1,282	2,598	3,608	1,795	420	234	301	487	112	96	182
Ear and mastoid diseases:													
Both sexes	5,069	103	132	368	237	69	115	45	30	103	33	14	13
Male	2,666	105	141	454	238	91	158	21	24	57	3	5	29
Female	2,403	102	122	281	237	46	73	62	34	150	69	25	------
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia and neuritis:													
Both sexes	11,775	327	305	87	160	367	627	121	306	302	399	762	191
Male	7,265	403	384	9	129	531	911	4	363	420	437	1,066	247
Female	4,510	245	230	170	190	202	342	205	265	183	353	397	148
Rheumatism and related diseases:													
Both sexes	8,172	273	212	2	78	68	22	39	172	408	476	704	1,145
Male	4,217	278	223	------	88	92	39	28	142	370	605	902	859
Female	3,954	256	201	4	68	44	5	46	195	448	319	466	1,367
Degenerative diseases:													
Both sexes	28,099	1,123	729	99	232	237	239	290	865	634	1,280	2,623	9,490
Male	12,971	1,130	686	43	272	308	92	181	271	483	916	2,343	11,645
Female	15,129	1,149	771	157	193	164	386	406	434	786	1,727	2,959	7,811
Skin diseases:													
Both sexes	5,585	133	145	250	169	195	117	96	80	100	98	168	105
Male	2,112	119	112	42	111	97	118	163	92	152	104	236	94
Female	3,474	149	177	469	225	294	116	47	71	48	91	87	113
Female genital and puerperal diagnoses:													
Both sexes	21,329	615	553	5	------	10	191	1,623	1,832	963	279	66	66
Female	21,329	1,129	1,087	11	------	21	382	2,807	3,190	1,934	621	146	117
Accidental injuries:													
Both sexes	22,565	690	585	205	384	489	426	765	652	707	636	1,054	2,339
Male	14,314	830	758	312	576	633	586	1,358	943	1,035	793	951	1,139
Female	8,251	557	420	94	197	343	265	333	436	377	445	1,178	3,274
All other diseases:													
Both sexes	18,590	466	482	416	532	677	318	238	479	484	593	443	875
Male	7,911	393	419	398	561	495	370	137	336	368	492	417	341
Female	10,645	534	542	427	503	861	266	312	585	601	715	474	401

[1] Disability refers to inability to work, attend school, care for home or pursue other usual activities on account of illness for 1 or more days, regardless of employment status and age. All days in bed are counted as days of disability.

[2] For details about inclusions in the diagnosis groups and International List numbers, see table 7.

[3] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

[4] Adjusted by the direct method as described in note to table 7.

[5] Days refer to those within the study year only but on both complete and incomplete cases; in computing days, cases with an unknown number of days of disability were put in at an average based on cases of the same diagnosis group with known days of disability, exclusive of the few cases that were disabled throughout the year of observation.

TABLE 12.—*Days in bed*[1] *from certain causes per 1,000 population of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole or primary diagnoses only]

Sex and diagnosis[2] group	All ages[3]: Number of days	All ages[3]: Adjusted[4]	All ages[3]: Crude	Age[6]: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Annual days[5] in bed per 1,000 population											
Minor respiratory diseases:													
Both sexes	29,631	739	769	1,184	943	644	511	560	692	620	697	726	987
Male	13,242	637	701	1,254	908	645	439	434	588	501	542	590	506
Female	16,376	833	834	1,116	977	642	583	651	769	740	886	889	1,362
Other respiratory diseases:													
Both sexes	19,339	524	502	401	539	479	362	656	615	453	421	669	768
Male	8,872	472	470	477	518	382	430	179	738	466	134	1,081	217
Female	10,455	563	533	319	560	577	294	1,003	524	440	774	173	1,196
Minor digestive diseases:													
Both sexes	3,957	99	103	232	90	60	48	40	62	92	91	150	217
Male	1,613	80	85	208	87	48	31	26	72	55	41	128	172
Female	2,344	120	119	258	94	73	64	50	53	128	151	176	253
Other digestive diseases:													
Both sexes	8,770	266	228	38	93	167	202	343	363	286	250	427	604
Male	3,293	199	174	44	103	156	132	291	322	189	220	228	272
Female	5,477	330	279	32	82	179	271	381	394	385	266	667	863
Communicable diseases:													
Both sexes	16,765	338	435	797	1,044	693	172	118	135	196	118	40	59
Male	7,737	305	409	801	1,069	572	185	93	106	91	123	29	-----
Female	9,028	369	460	800	1,021	815	158	136	156	303	113	54	105
Ear and mastoid diseases:													
Both sexes	1,752	36	45	113	100	34	32	25	19	16	11	4	10
Male	862	35	46	118	90	50	43	18	10	17	-----	-----	23
Female	890	37	45	109	111	18	20	30	26	15	25	9	-----
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia and neuritis:													
Both sexes	6,899	177	179	134	93	200	475	33	106	108	373	174	83
Male	3,391	163	179	121	40	215	646	6	12	64	405	109	80
Female	3,508	187	179	149	145	186	305	52	175	153	335	253	86
Rheumatism and related diseases:													
Both sexes	4,145	131	108	5	89	49	12	31	93	223	145	142	707
Male	1,833	105	97	-----	127	76	16	23	71	197	145	100	346
Female	2,312	151	118	10	52	22	8	37	110	248	145	193	989
Degenerative diseases:													
Both sexes	15,042	613	390	77	48	128	167	89	182	307	781	1,455	5,320
Male	5,349	486	283	14	24	149	5	62	161	167	442	704	5,469
Female	9,693	761	494	145	72	108	330	75	197	449	1,195	2,357	5,203
Skin diseases:													
Both sexes	1,299	34	34	65	22	16	32	12	22	30	39	19	126
Male	675	34	36	72	14	19	31	18	19	41	47	-----	114
Female	624	34	32	57	30	13	33	7	24	20	29	42	135
Female genital and puerperal diagnoses:													
Both sexes	14,296	415	371	2	-----	3	126	1,113	1,309	591	145	59	41
Female	14,296	757	728	4	-----	5	251	1,925	2,279	1,188	323	130	73
Accidental injuries:													
Both sexes	8,486	271	220	112	178	194	136	198	153	252	218	280	1,588
Male	5,035	295	266	152	264	282	215	319	180	329	255	315	959
Female	3,451	241	176	70	94	104	56	110	133	174	172	238	2,078
All other diseases:													
Both sexes	11,822	281	307	703	166	334	242	60	210	296	292	279	247
Male	5,247	235	278	826	199	176	286	43	147	179	157	302	105
Female	6,354	317	324	498	134	493	198	73	257	413	458	251	358

[1] Days in bed on account of illness that caused the patient to remain in bed for 1 or more days; all days in hospital are counted as days in bed.
[2] For details about inclusions in the diagnosis groups and International List numbers, see table 7.
[3] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.
[4] Adjusted by the direct method as described in note to table 7.
[5] Days refer to those within the study year only but on both complete and incomplete cases; in computing days, cases with an unknown number of days in bed were put in at an average based on cases of the same diagnosis group with known days in bed, exclusive of the few cases in bed throughout the year of observation.
[6] Rates plotted in figs. 5 and 6 in broader ages: Other respiratory, 5–14, male 457, female 567; 15–24, male 337, female 610; 25–44, male 557, female 484; 45 and over, male 392, female 713; ear and mastoid, 45 and over, male 3.2, female 15.7; nervous, 15–24, male 409, female 192; skin, 45–64, male 32.5, female 33.1.

TABLE 13.—*Days in bed per case [1] of certain diagnoses for persons of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole or primary diagnoses only]

Sex and diagnosis [2] group	All ages [3]: Number of cases	All ages [3]: Adjusted [4]	All ages [3]: Crude	Age [6]: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Bed days per bed case [5]											
Minor respiratory diseases:													
Both sexes	6,691	4.6	4.4	4.4	4.3	3.9	4.1	4.3	4.5	4.2	5.0	5.5	7.0
Male	3,103	4.3	4.3	4.5	4.2	4.1	3.8	4.0	4.2	4.0	4.5	5.0	4.3
Female	3,585	4.8	4.6	4.3	4.3	3.8	4.3	4.5	4.8	4.4	5.5	6.1	8.5
Other respiratory diseases:													
Both sexes	1,508	14.9	12.8	7.4	7.4	11.5	12.5	20.1	20.6	18.4	20.5	30.8	30.6
Male	723	14.0	12.3	8.9	6.8	10.2	15.6	6.7	26.8	18.3	8.0	39.5	11.9
Female	783	15.6	13.4	5.9	8.1	12.6	9.7	27.3	16.6	18.5	30.7	11.6	39.5
Minor digestive diseases:													
Both sexes	1,139	3.6	3.5	3.5	2.7	2.6	2.5	2.6	3.3	4.8	3.9	5.1	4.7
Male	482	3.5	3.3	3.5	2.8	2.2	2.5	2.1	4.8	3.3	2.6	6.1	5.4
Female	657	3.7	3.6	3.6	2.6	2.8	2.5	2.9	2.5	6.0	4.7	4.5	4.4
Other digestive diseases:													
Both sexes	621	15.0	14.1	7.2	8.8	12.3	11.2	14.3	16.1	14.5	13.7	21.0	24.1
Male	248	14.1	13.3	6.9	10.0	12.0	11.2	15.3	15.2	13.4	15.6	20.3	17.0
Female	373	15.5	14.7	7.7	7.7	12.7	11.2	13.7	16.8	15.1	12.3	21.2	26.9
Communicable diseases:													
Both sexes	2,241	7.7	7.5	6.3	6.7	9.9	6.7	9.2	7.9	14.4	10.4	4.9	9.8
Male	1,096	7.2	7.1	6.5	6.8	8.2	7.9	10.4	7.1	8.5	8.4	3.8	-----
Female	1,145	8.2	7.9	6.1	6.7	11.7	5.7	8.7	8.4	18.2	15.5	6.0	9.8
Ear and mastoid diseases:													
Both sexes	281	6.2	6.2	6.1	7.0	5.3	6.1	5.9	6.2	5.2	6.2	6.0	10.0
Male	139	6.3	6.2	6.0	6.3	6.3	8.3	8.0	5.8	4.5	-----	-----	10.0
Female	142	6.1	6.3	6.2	7.6	3.6	3.9	5.3	6.4	6.1	6.2	6.0	-----
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia and neuritis:													
Both sexes	201	31.4	34.3	27.4	41.0	70.4	103.6	9.9	14.5	16.5	54.4	17.1	10.4
Male	63	49.5	53.8	21.2	14.1	82.3	140.9	5.0	7.3	27.3	149.4	17.6	11.7
Female	138	23.7	25.4	36.4	84.0	60.1	66.3	10.7	15.3	14.1	28.0	16.9	9.6
Rheumatism and related diseases:													
Both sexes	326	12.8	12.7	28.0	26.7	18.7	7.2	11.0	8.8	15.3	6.8	6.0	27.2
Male	147	11.5	12.5	-----	29.8	25.0	8.0	21.0	12.1	13.3	6.7	5.3	13.7
Female	179	13.5	12.9	28.0	21.4	9.8	6.0	9.0	7.8	17.5	6.8	6.5	37.0
Degenerative diseases:													
Both sexes	541	30.0	27.8	30.5	16.2	32.6	31.9	11.3	16.5	17.5	30.8	33.5	36.1
Male	198	30.0	27.0	5.4	11.2	38.1	8.0	18.3	29.7	13.1	27.2	19.5	39.2
Female	343	30.8	28.3	55.6	18.9	27.1	33.5	9.2	13.0	20.1	32.7	45.1	33.9
Skin diseases:													
Both sexes	176	7.6	7.4	10.5	5.9	4.2	4.7	4.2	4.4	7.8	8.7	9.3	21.0
Male	91	7.5	7.4	11.9	3.3	4.8	4.7	8.0	3.0	8.6	9.6	-----	25.0
Female	85	7.7	7.3	9.0	9.6	3.6	4.6	2.3	6.0	6.4	7.3	9.3	19.0
Female genital and puerperal diagnoses:													
Both sexes	1,217	11.7	11.7	10.0	-----	1.7	8.0	10.8	12.1	12.5	11.6	17.4	10.3
Female	1,217	11.7	11.7	10.0	-----	1.7	8.0	10.8	12.1	12.5	11.6	17.4	10.3
Accidental injuries:													
Both sexes	866	11.7	9.8	7.7	7.4	7.7	6.6	8.9	7.1	9.8	10.0	11.4	45.3
Male	505	11.1	10.0	9.1	8.7	8.9	7.3	11.4	6.8	11.0	11.2	14.1	38.1
Female	361	12.2	9.6	5.7	5.2	5.7	4.8	6.1	7.6	8.0	8.3	8.8	48.6
All other diseases:													
Both sexes	920	12.2	12.9	16.4	8.9	24.6	21.7	3.9	8.6	11.5	10.6	11.7	9.5
Male	365	14.0	14.4	16.7	10.4	16.2	33.5	5.4	13.5	11.6	8.8	15.2	9.2
Female	551	11.1	11.5	14.2	7.3	30.2	14.3	3.5	7.5	11.5	11.7	8.8	9.6

[1] Cases that caused the patient to remain in bed for 1 or more days; all hospital cases and days are counted as bed cases and bed days.

[2] For details about inclusions in the diagnosis groups and International List numbers, see table 7.

[3] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

[4] Figures in this "adjusted" column represent the result of dividing the adjusted rate for bed days per 1,000 (table 12) by the adjusted rate for bed cases per 1,000 (table 9).

[5] Cases represent periods of illness classified according to the primary cause (for details about classification of causes, see a preceding paper (*1*)). Cases include those with prior onset that extended into the study year and those still sick at the last visit; days refer to duration within the study year only but on both complete and incomplete cases.

[6] Rates plotted in figs. 5 and 6 in broader ages: Other respiratory, 5–14, male 7.7, female 9.7; 15–24, male 12.4, female 18.4; 25–44, male 22.3, female 17.4; 45 and over, male 19.9, female 30.0; minor digestive, 5–14, male 2.6, female 2.7; 15–24, male 2.4, female 2.7; 25–44, male 4.0, female 4.2; 45–64, male 3.9, female 4.7; communicable diseases, 5–14, male 7.2, female 8.0; 15–24, male 8.3, female 6.7; 25–44, male 7.7, female 12.8; 45 and over, male 7.6, female 11.5: ear and mastoid, 5–14, male 6.3, female 6.8; 15–24, male 8.2, female 4.5; 25–44, male 4.9, female 6.3; 45 and over, male 10.0, female 6.1; nervous, 5–14, male 43.4, female 70.1; 15–24, male 123.9, female 40.6; 45–64, male 83.5, female 24.0; rheumatism, under 15, male 28.0, female 17.5; 15–24, male 11.3, female 8.1; 25–44, male 13.1, female 12.4; 45–64, male 6.3, female 6.7; degenerative, under 15, male 20.4, female 31.2; 15–24, male 15.8, female 23.8; 25–44, male 17.3, female 17.1; 45–64, male 23.4; female 37.5: skin, 5–14, male 3.9, female 6.8; 15–24, male 5.3, female 4.0; 25–44, male 5.7, female 6.2; 45–64, male 9.6, female 8.0; female genital and puerperal, 5–14, 1.7; 45–64, 12.2.

Table 14.—*Mortality from certain causes per 100,000 white population of specific ages for each sex—United States registration States,[1] 1929–30*

[Sole or primary diagnoses only]

Sex and diagnosis[2] group with International List numbers, 1920 revision	All ages[3]: Number of deaths	All ages[3]: Adjusted[4]	All ages[3]: Crude	Age: Under 5	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65 and over
		Annual death rate per 100,000 population											
Respiratory diseases (11, 31, 97–107, 109):													
Both sexes	384,239	184.3	184.3	362.0	35.0	24.6	62.0	107.1	123.4	148.0	189.3	284.1	860.4
Male	211,077	199.5	199.9	396.3	36.5	22.8	55.8	95.1	126.2	180.6	241.3	336.5	847.6
Female	173,162	167.9	168.3	326.4	33.5	26.4	68.2	118.8	120.7	113.4	132.9	228.3	873.2
Digestive diseases (110–127):													
Both sexes	160,753	77.1	77.1	248.6	21.3	17.6	20.7	23.1	30.6	51.5	85.8	141.1	266.0
Male	89,986	84.9	85.2	277.5	22.4	19.7	24.6	26.5	33.1	57.8	96.7	156.7	276.5
Female	70,767	69.0	68.8	218.6	20.1	15.4	16.9	19.7	28.0	44.8	74.0	124.4	255.7
Communicable diseases (1–10, 12–30, 32–42):													
Both sexes	97,214	46.6	46.6	200.0	48.6	23.3	25.3	25.0	22.1	24.1	31.8	40.5	63.1
Male	53,784	50.8	50.9	207.5	50.6	25.0	27.8	27.0	23.5	27.0	38.9	51.4	71.6
Female	43,430	42.3	42.2	192.1	46.5	20.9	22.8	23.1	20.8	21.2	24.0	28.7	54.7
Ear and mastoid diseases (80):													
Both sexes	7,693	3.7	3.7	13.1	5.2	3.1	2.6	1.8	1.8	1.9	2.5	3.3	4.1
Male	4,551	4.3	4.3	15.3	5.8	3.3	3.4	2.4	2.2	2.2	2.9	3.7	4.5
Female	3,142	3.1	3.1	10.9	4.6	2.9	1.7	1.2	1.4	1.5	2.0	2.8	3.6
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis (70–73, 76–82, 84):													
Both sexes	42,807	20.5	20.5	28.9	6.9	5.6	7.2	8.1	11.2	19.9	30.3	43.8	75.3
Male	25,735	24.3	24.4	31.9	7.7	6.4	8.6	9.5	13.0	25.0	37.2	53.8	85.2
Female	17,072	16.7	16.6	25.7	6.0	4.7	5.8	6.7	9.4	14.5	22.9	33.0	65.6
Rheumatism and related diseases (51, 52):													
Both sexes	7,604	3.7	3.7	1.3	3.0	3.4	2.6	1.8	1.7	1.9	3.1	6.2	20.5
Male	3,412	3.3	3.2	1.4	3.0	3.2	2.7	1.7	1.5	1.7	2.8	5.5	16.1
Female	4,192	4.1	4.1	1.3	3.1	3.6	2.5	2.0	1.9	2.1	3.4	7.0	24.8
Degenerative diseases (43–50, 57, 74, 75, 83, 87–92, 128–135):													
Both sexes	1,137,284	545.5	545.5	31.8	19.6	26.1	34.7	42.3	73.2	198.4	571.6	1,536.1	5,539.0
Male	597,597	566.8	565.9	33.6	19.3	23.8	31.5	40.7	67.9	186.8	573.1	1,632.2	5,833.8
Female	539,687	523.8	524.5	29.9	20.0	28.5	31.9	43.8	78.4	210.6	509.9	1,433.7	5,247.1
Skin diseases (151–154):													
Both sexes	5,661	2.7	2.7	5.0	.35	.67	.90	1.06	1.2	1.4	2.3	4.2	18.3
Male	3,217	3.0	3.0	5.5	.41	.74	1.10	.87	1.1	1.6	2.6	4.9	21.2
Female	2,444	2.4	2.4	4.6	.30	.60	.71	1.26	1.2	1.1	2.1	3.4	15.4

Female genital and puerperal diagnoses (137–150):													
Both sexes	33, 866	16. 2	16. 2	. 05	. 02	. 31	13. 2	30. 2	37. 4	32. 1	11. 9	5. 7	6. 8
Female	33, 866	32. 7	32. 9	. 10	. 05	. 63	26. 4	59. 6	74. 4	65. 0	24. 0	11. 8	13. 5
Accidental injuries (165–203):													
Both sexes	211, 181	101. 3	101. 3	71. 3	42. 3	34. 4	63. 8	80. 6	84. 9	100. 5	128. 6	161. 9	357. 5
Male	155, 273	146. 6	147. 0	79. 5	55. 2	52. 7	98. 9	111. 7	139. 0	162. 8	203. 8	249. 8	396. 6
Female	55, 908	54. 2	54. 3	62. 9	28. 9	15. 7	28. 6	33. 1	31. 3	34. 8	47. 0	74. 4	318. 6
All other diseases (53–56, 58–69, 85, 93–96, 108, 136, 155–164, 204, 205):													
Both sexes	220, 346	105. 7	105. 7	740. 2	9. 3	7. 2	8. 4	10. 3	15. 3	27. 9	47. 0	78. 4	298. 2
Male	121, 537	114. 7	115. 1	842. 5	10. 8	8. 5	8. 7	9. 5	15. 4	29. 7	50. 2	83. 0	287. 2
Female	98, 809	96. 2	96. 0	652. 7	7. 8	5. 9	8. 1	11. 1	15. 2	25. 9	43. 5	73. 5	309. 2
Important specific causes in respiratory group:													
Respiratory tuberculosis (31):													
Both sexes	111, 146	53. 3	53. 3	7. 1	2. 3	5. 1	32. 8	72. 3	78. 4	74. 4	77. 5	83. 8	98. 1
Male	61, 479	58. 0	58. 2	7. 4	2. 1	3. 3	21. 5	56. 1	76. 1	91. 0	103. 1	108. 9	110. 6
Female	49, 667	48. 1	48. 3	6. 7	2. 4	6. 9	44. 2	88. 0	80. 6	56. 8	49. 6	57. 0	85. 7
Pneumonia (100,101):													
Both sexes	169, 390	81. 3	81. 2	247. 4	16. 6	10. 3	15. 7	19. 0	26. 1	46. 2	71. 8	129. 7	439. 4
Male	95, 298	90. 1	90. 2	269. 9	17. 7	10. 5	19. 3	22. 5	30. 9	59. 1	91. 9	151. 3	434. 2
Female	74, 092	72. 0	72. 0	224. 1	15. 5	10. 1	12. 1	15. 7	21. 3	32. 5	50. 0	106. 7	444. 6
Important specific causes in degenerative group:													
Heart diseases (87–90):													
Both sexes	434, 095	208. 2	208. 2	12. 6	10. 4	15. 5	19. 0	21. 1	31. 0	71. 2	198. 6	544. 5	2, 174. 5
Male	238, 536	226. 2	225. 9	13. 9	9. 9	13. 9	18. 9	19. 4	30. 6	80. 3	235. 7	635. 0	2, 286. 9
Female	195, 559	189. 4	190. 1	11. 3	10. 9	17. 0	19. 2	22. 8	31. 4	61. 6	158. 3	448. 2	2, 062. 4
Cerebral hemorrhage and paralysis (74, 75, 83):													
Both sexes	184, 190	88. 3	88. 3	2. 8	. 79	. 85	1. 4	2. 3	4. 3	18. 0	74. 3	237. 9	1, 027. 2
Male	93, 823	89. 1	88. 9	3. 2	. 75	. 85	1. 5	2. 2	4. 5	17. 9	71. 7	250. 6	1, 029. 0
Female	90, 367	87. 5	87. 8	2. 4	. 83	. 84	1. 3	2. 5	4. 1	18. 1	77. 0	224. 3	1, 025. 4
Cancer (all sites) (43–49):													
Both sexes	211, 524	101. 5	101. 5	4. 0	1. 9	2. 2	3. 5	5. 1	15. 4	56. 2	158. 8	359. 5	806. 7
Male	96, 071	90. 9	91. 0	4. 2	2. 0	2. 1	4. 0	5. 6	10 6	35. 2	117. 8	321. 4	809. 9
Female	115, 453	112. 8	112. 2	3. 8	1. 9	2. 3	3. 1	4. 6	20. 1	78. 3	203. 4	400. 2	803. 4
Kidney diseases (128, 129, 131):													
Both sexes	185, 546	89. 0	89. 0	9. 3	3. 9	4. 7	6. 6	9. 3	15. 6	37. 0	90. 2	232. 6	897. 2
Male	99, 130	94. 1	93. 9	9. 3	3. 8	4. 1	6. 1	8. 8	14. 5	34. 8	92. 5	251. 1	969. 1
Female	86, 416	83. 8	84. 0	9. 4	4. 0	5. 3	7. 1	9. 9	16. 7	39. 4	87. 6	212. 8	825. 6
Population (years of life) [5] in thousands:													
Both sexes	[3] 208, 492	----------	----------	18, 935	20, 904	20. 149	19, 276	18, 040	31, 891	29, 549	22, 586	15, 006	12, 008
Male	105, 595	----------	----------	9, 634	10, 604	10, 201	9, 652	8, 886	15, 872	15, 181	11, 752	7, 739	5, 994
Female	102, 897	----------	----------	9, 301	10, 300	9, 948	9, 624	9, 154	16, 019	14, 368	10, 834	7, 267	6, 014

[1] Registration States include all except Texas and South Dakota in 1929 and all except Texas in 1930.

[2] The detailed causes included in the broad diagnosis groups for deaths differ slightly from those in the sickness tables. The differences are due to: (*a*) The illness classification subdivides some of the detailed International List numbers used for deaths; (*b*) a revised International List was used in tabulating deaths for 1930, so the data for 1929 and 1930 had to be put together on the basis of two lists. Some of the illness subdivisions involve large frequencies for illness but none involve large frequencies for deaths; therefore, the two classifications are substantially comparable.

[3] "All ages" includes a few of unknown age.

[4] Rates for each sex adjusted by the direct method to the age distribution of both sexes combined, i. e., the age distribution of the white population of the registration States in 1930.

[5] Population in 1930 × 2, with adjustment for South Dakota which was not in the registration area in 1929.

DEATHS DURING WEEK ENDED DECEMBER 23, 1939

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Dec. 23, 1939	Corresponding week, 1938
Data from 88 large cities of the United States:		
Total deaths	8,450	8,555
Average for 3 prior years	[1] 8,488	
Total deaths, 51 weeks of year	416,962	411,377
Deaths under 1 year of age	461	490
Average for 3 prior years	[1] 505	
Deaths under 1 year of age, 51 weeks of year	25,088	26,466
Data from industrial insurance companies:		
Policies in force	66,416,008	68,268,314
Number of death claims	12,546	13,049
Death claims per 1,000 policies in force, annual rate	9.8	10.0
Death claims per 1,000 policies, 51 weeks of year, annual rate	9.8	9.2

[1] Data for 86 cities.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

Beginning with this issue of the Public Health Reports, some changes are being made in the tabular presentation of current data on disease prevalence. The period covered by the weekly telegraphic reports for the nine important communicable diseases is being advanced 1 week and will be for the week immediately preceding the week of issue instead of for the second week preceding, as formerly. A brief text summary of important developments revealed by the weekly reports and of other current items of interest will be presented each week if found practicable.

The monthly reports from States, which have heretofore been printed each week as received, will be compiled and published at suitable intervals after the reports from all States have been received.

Comment regarding these changes and any suggestions with reference to improvement in publishing this current information which will make it of greater value are solicited from all who have occasion to make use of these data.

REPORTS FROM STATES FOR WEEK ENDED JANUARY 6, 1940

Summary

The rise in the incidence of influenza, which began early in November last year, continued during the current week, with a total of 9,630 cases reported as compared with 7,097 cases for the preceding week and with 2,423 cases for the corresponding median week of the 5-year period 1935–39. The curve is similar to that for 1937, which reached the peak during the last week in January. In 1939 the peak came in March, and the curve remained well above the median until midsummer. Of the total cases, 7,357 were reported from 7 States in the South Atlantic and South Central groups, while the incidence remained low in the New England, Middle Atlantic, and North Central areas.

No important changes are shown for the other eight communicable diseases included in these reports, the incidence of which remains in most instances below the median expectancy.

Cases of certain diseases reported by telegraph by State health officers for the week ended Jan. 6, 1940, and comparison with corresponding week of 1939 and 5-year median

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

In these and the following tables, a zero (0) indicates a positive report and has the same significance as any other figure, while leaders (----) represent no report, with the implication that cases or deaths may have occurred but were not reported to the State health officer.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939	
NEW ENG.												
Maine	2	4	4	10	1	13	91	5	74	0	0	0
N. Hampshire	0	0	0	----	----	----	5	1	24	0	0	0
Vermont	0	0	0	----	----	----	32	13	13	0	0	0
Massachusetts	6	10	10	----	----	----	193	354	241	0	1	1
Rhode Island	0	0	0	----	----	----	150	1	11	0	0	0
Connecticut	0	2	4	7	10	31	204	143	143	1	0	2
MID. ATL.												
New York	12	26	36	[1] 16	[1] 44	[1] 44	222	1,014	543	0	6	6
New Jersey	12	24	22	16	14	22	17	24	39	0	0	3
Pennsylvania	24	43	50	----	----	----	33	75	283	2	2	3
E. NO. CEN.												
Ohio	39	62	51	5	----	8	37	36	79	4	4	4
Indiana	17	41	39	46	12	40	11	11	11	1	4	2
Illinois	32	52	52	18	18	22	26	45	45	4	2	9
Michigan [2]	2	5	11	----	----	----	----	189	45	0	0	2
Wisconsin	0	2	4	49	62	44	155	359	359	0	0	1
W. NO. CEN.												
Minnesota	4	3	5	1	----	1	100	622	66	0	0	1
Iowa	8	9	8	2	----	2	48	129	51	1	0	3
Missouri	11	13	27	3	70	150	4	7	13	1	1	1
North Dakota	1	4	2	46	34	34	1	301	31	0	0	0
South Dakota	0	7	0	14	6	1	1	389	5	0	0	0
Nebraska	3	8	5	13	----	----	156	39	39	0	1	1
Kansas	6	10	10	238	16	13	172	9	9	2	2	2
SO. ATL.												
Delaware	2	2	2	----	----	----	1	3	7	0	0	0
Maryland [2, 3]	4	2	9	24	4	37	1	250	72	0	1	3
Dist. of Col.	3	7	7	----	2	4	1	3	10	0	1	1
Virginia [4]	22	37	34	557	454	----	32	60	112	1	2	4
West Virginia	9	11	14	15	21	76	3	14	28	0	0	2
North Carolina [3]	53	33	33	450	3	24	49	317	317	2	2	2
South Carolina [3]	26	14	5	3,154	909	720	11	5	12	1	6	1
Georgia [3]	21	16	15	1,433	133	133	27	61	0	0	0	0
Florida [3]	10	5	18	107	1	5	11	70	19	1	3	3
E. SO. CEN.												
Kentucky	10	14	14	13	56	56	2	60	199	0	2	7
Tennessee [3]	12	10	13	143	36	147	39	7	9	0	3	4
Alabama [3]	16	12	18	974	158	250	25	46	46	0	3	3
Mississippi [2]	13	6	11	----	----	----	----	----	0	0	1	1
W. SO. CEN.												
Arkansas	17	14	12	336	181	92	3	44	5	0	2	2
Louisiana [3]	12	11	13	15	7	20	1	63	21	0	3	1
Oklahoma	14	18	16	257	222	119	2	174	7	0	1	1
Texas [3]	25	34	66	453	492	427	69	50	51	0	0	1

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended Jan. 6, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939	
MOUNTAIN												
Montana	1	3	3	81	5	14	15	288	17	0	0	1
Idaho	1	5	0		4	3	53	63	11	0	0	0
Wyoming	0	0	1	21			6	14	4	1	0	0
Colorado	5	16	9	163	21		37	43	43	0	2	1
New Mexico	2	5	4	8	2	2	0	5	10	1	2	1
Arizona	9	8	8	178	138	116	6	2	6	1	0	1
Utah [1]	0	0	0	320	7		96	16	16	0	0	0
PACIFIC												
Washington	1	0	2				570	182	44	0	0	0
Oregon	5	0	2	281	71	71	66	18	18	0	0	0
California	21	31	40	163	41	78	90	1,046	126	1	5	5
Total	488	639	694	9,630	3,255	3,255	2,883	6,670	6,670	25	60	95

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median, 1935–1939	Week ended—		Median, 1935–1939	Week ended—		Median, 1935–1939	Week ended—		Median, 1935–1939
	Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939	
NEW ENG.												
Maine	1	0	0	5	11	22	0	0	0	0	0	0
N. Hampshire	0	0	0	3	15	13	0	0	0	1	0	0
Vermont	0	0	0	2	5	11	0	0	0	0	0	0
Massachusetts	2	1	1	96	142	228	0	0	0	1	0	2
Rhode Island	0	0	0	6	6	24	0	0	0	0	0	0
Connecticut	0	0	0	72	39	51	0	0	0	0	0	1
MID. ATL.												
New York	4	0	1	290	361	549	0	0	0	4	4	4
New Jersey	0	0	0	177	130	121	0	0	0	0	7	2
Pennsylvania	2	0	0	370	281	508	0	0	0	9	7	9
E. NO. CEN.												
Ohio	1	1	0	393	642	378	3	24	4	7	4	4
Indiana	1	0	0	187	258	190	11	51	15	1	1	1
Illinois	0	3	1	421	383	521	2	18	12	3	2	4
Michigan [2]	0	0	0	116	248	248	0	3	0	0	0	1
Wisconsin	6	0	0	141	188	274	4	10	10	2	0	0
W. NO. CEN.												
Minnesota	1	1	0	101	89	131	3	9	9	0	0	0
Iowa	3	0	0	69	94	100	16	16	16	0	4	1
Missouri	0	0	0	57	148	148	1	11	11	1	2	2
North Dakota	0	0	0	33	28	28	0	8	8	0	1	0
South Dakota	0	0	0	12	29	45	9	14	5	0	0	0
Nebraska	0	3	1	35	49	49	3	11	8	0	0	2
Kansas	1	1	0	142	198	167	0	7	11	2	1	1
SO. ATL.												
Delaware	0	0	0	11	14	19	0	0	0	0	2	0
Maryland [1] [2]	0	0	0	56	29	64	0	0	0	2	2	2
Dist. of Col.	2	0	0	11	11	18	0	0	0	1	0	0
Virginia [4]	0	0	0	63	54	54	0	0	0	3	10	9
West Virginia	0	0	0	65	60	64	0	0	0	1	2	[illegible]
North Carolina [3]	1	0	0	72	52	52	0	0	0	0	1	[illegible]
South Carolina [3]	1	0	0	5	25	10	0	0	0	2	4	4
Georgia [3]	1	3	1	42	18	15	0	1	0	3	[illegible]	3
Florida [3]	0	0	0	14	7	9	0	0	0	2	1	1
E. SO. CEN.												
Kentucky	1	1	0	39	78	72	0	6	1	[illegible]	5	5
Tennessee [3]	0	0	0	34	38	42	0	1	0	1	0	2
Alabama [3]	1	0	0	27	14	14	0	0	0	0	0	2
Mississippi [3]	0	0	0	6	16	13	0	0	0	2	4	1

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended Jan. 6, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median, 1935–1939	Week ended—		Median, 1935–1939	Week ended—		Median, 1935–1939	Week ended—		Median, 1935–1939
	Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939	
W. SO. CEN.												
Arkansas	0	0	0	31	20	18	4	2	2	2	0	2
Louisiana [3]	1	0	1	18	23	23	0	1	1	1	11	11
Oklahoma	0	0	0	28	47	47	8	27	0	5	1	2
Texas [3]	0	1	1	45	73	73	0	1	2	4	12	12
MOUNTAIN												
Montana	0	0	0	39	21	35	1	4	13	0	1	0
Idaho	3	0	0	10	14	25	0	12	7	2	0	0
Wyoming	0	0	0	7	9	18	0	0	4	0	0	0
Colorado	0	0	0	33	54	58	5	6	6	4	2	1
New Mexico	0	0	0	6	10	16	0	0	0	2	0	3
Arizona	0	0	0	2	0	15	3	8	0	8	2	1
Utah [2]	1	0	0	18	26	61	0	0	0	0	0	0
PACIFIC												
Washington	1	0	0	39	59	50	1	11	11	2	1	1
Oregon	0	1	0	32	109	51	0	5	5	1	0	1
California	8	0	3	111	234	234	0	24	18	2	2	8
Total	43	16	21	3,597	4,450	5,167	74	291	276	81	98	123

Division and State	Whooping cough		Division and State	Whooping cough	
	Week ended—			Week ended—	
	Jan. 6, 1940	Jan. 7, 1939		Jan. 6, 1940	Jan. 7, 1939
New England:			South Atlantic—Continued.		
Maine	41	36	West Virginia	8	18
New Hampshire	4	2	North Carolina [3]	32	179
Vermont	54	58	South Carolina [3]	7	68
Massachusetts	104	248	Georgia [3]	12	19
Rhode Island	21	39	Florida [3]	2	9
Connecticut	59	94	East S. Central:		
Middle Atlantic:			Kentucky	15	19
New York	389	590	Tennessee [3]	19	8
New Jersey	89	475	Alabama [3]	8	14
Pennsylvania	216	215	Mississippi [2]	----------	----------
East N. Central:			West S. Central:		
Ohio	132	285	Arkansas	1	22
Indiana	29	31	Louisiana [3]	2	7
Illinois	120	419	Oklahoma	3	13
Michigan [2]	25	100	Texas [3]	55	64
Wisconsin	103	209	Mountain:		
West N. Central:			Montana	2	5
Minnesota	34	35	Idaho	6	4
Iowa	4	6	Wyoming	8	3
Missouri	12	10	Colorado	27	49
North Dakota	4	23	New Mexico	7	4
South Dakota	0	3	Arizona	2	18
Nebraska	64	12	Utah [2]	52	12
Kansas	20	23	Pacific:		
South Atlantic:			Washington	25	30
Delaware	13	6	Oregon	52	8
Maryland [2 3]	46	35	California	91	66
Dist. of Columbia	7	21			
Virginia [4]	51	81	Total	2,077	3,695

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Jan. 6, 1940, 24 cases as follows: Maryland, 1; North Carolina, 1; South Carolina, 1; Georgia, 7; Florida, 1; Tennessee, 1; Alabama, 1; Louisiana, 3; Texas, 8.
[4] Rocky Mountain spotted fever, week ended Jan. 6, 1940, Virginia, 1 case.

PSITTACOSIS IN ARIZONA

A report of three cases of psittacosis in Tucson, Ariz., was confirmed by a letter dated December 27, 1939, from Dr. J. D. Dunshee, reporting for the Superintendent of Health of Arizona. Two young adults of one family became ill on October 7 and November 7, respectively, and a nurse on the first case became ill on November 3, 1939. Two cases have recovered and the nurse is well on the road to recovery. The family owned two love birds which were set free when the possibility of psittacosis was mentioned. They had been shipped from a pet shop in California on April 21, 1939. However, other birds in the same group were examined with negative results.

WEEKLY REPORTS FROM CITIES

City reports for week ended December 23, 1939

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	185	432	82	1,296	826	1,411	22	350	25	1,039	-------
Current week [1]	99	233	40	462	494	958	5	297	18	573	-------
Maine:											
Portland	2	------	0	1	0	1	0	0	0	0	19
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	12
Manchester	0	------	0	0	0	0	0	0	0	0	12
Nashua	0	------	0	0	0	0	0	0	0	0	2
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	1	11
Rutland	0	------	0	0	0	0	0	0	0	0	8
Massachusetts:											
Boston	1	------	0	12	12	41	0	10	0	32	228
Fall River	0	------	1	0	4	2	0	1	0	6	21
Springfield	0	------	0	0	0	1	0	2	0	4	43
Worcester	0	------	0	2	7	9	0	1	0	4	52
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	2	16
Providence	0	------	0	51	8	3	0	0	0	15	65
Connecticut:											
Bridgeport	0	------	0	0	0	5	0	2	0	0	23
Hartford	0	------	0	0	2	1	0	3	0	12	30
New Haven	0	2	0	0	1	6	0	0	0	4	-------
New York:											
Buffalo	0	------	0	2	7	7	0	7	0	3	148
New York	22	15	2	23	75	151	0	69	4	91	1,519
Rochester	1	------	0	2	3	8	0	0	0	2	91
Syracuse	1	------	0	0	5	4	0	1	0	10	57
New Jersey:											
Camden	0	------	0	1	2	5	0	3	0	0	24
Newark	0	5	0	4	3	14	0	6	0	13	88
Trenton	0	------	0	0	2	6	0	0	0	0	29
Pennsylvania:											
Philadelphia	3	5	2	7	20	43	0	18	1	48	471
Pittsburgh	0	8	1	3	13	18	0	7	1	10	182
Reading	1	------	0	0	0	0	0	0	0	4	34
Scranton	0	------	-------	1	-------	3	0	-------	0	2	-------
Ohio:											
Cincinnati	7	------	0	0	5	27	0	4	0	1	126
Cleveland	1	16	4	2	18	27	0	7	2	31	196
Columbus	2	------	0	1	2	5	0	1	0	0	107
Toledo	0	------	0	9	1	10	0	0	1	11	68

[1] Figures for Barre, Racine, Fargo. and Dallas estimated; reports not received.

City reports for week ended December 23, 1939—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Indiana:											
Anderson	0	------	0	0	0	3	0	0	0	3	6
Fort Wayne	1	------	0	0	0	4	0	1	0	0	30
Indianapolis	3	------	1	0	13	17	0	6	0	11	100
South Bend	0	------	0	0	1	1	0	0	0	0	22
Terre Haute	0	------	0	0	1	0	0	0	0	0	18
Illinois:											
Alton	0	------	0	0	0	3	0	0	0	0	8
Chicago	11	9	3	8	26	169	0	27	1	29	713
Elgin	3	------	0	1	0	5	0	0	0	0	9
Moline	0	------	0	0	0	3	0	0	0	0	12
Springfield	0	------	0	0	4	0	0	0	0	0	21
Michigan:											
Detroit	4	2	2	3	23	58	0	13	0	9	262
Flint	0	------	0	3	5	20	0	1	0	16	27
Grand Rapids	0	------	0	1	3	22	0	0	0	2	40
Wisconsin											
Kenosha	0	------	0	0	0	5	0	0	0	7	7
Madison	0	1	0	1	0	4	0	0	0	5	5
Milwaukee	0	------	0	1	8	32	0	2	0	6	87
Racine	------	------	------	------	------	------	------	------	------	------	------
Superior	0	------	0	1	0	1	0	0	0	0	9
Minnesota:											
Duluth	0	------	0	21	1	0	0	0	0	0	32
Minneapolis	0	------	1	4	6	26	0	2	0	2	109
St. Paul	0	------	0	0	0	24	0	0	0	30	38
Iowa:											
Cedar Rapids	0	------	------	7	------	0	0	------	0	1	------
Davenport	0	------	------	0	------	4	0	------	0	0	------
Des Moines	0	------	0	4	0	12	2	0	0	1	37
Sioux City	0	------	------	0	------	4	0	------	0	1	------
Waterloo	3	------	------	0	------	3	0	------	0	2	------
Missouri:											
Kansas City	0	------	0	0	6	21	0	5	0	1	72
St. Joseph	0	------	0	2	1	0	1	0	0	0	21
St. Louis	6	------	0	0	20	9	0	7	2	6	219
North Dakota:											
Fargo	------	------	------	------	------	------	------	------	------	------	------
Grand Forks	0	------	------	0	------	0	0	------	0	0	------
Minot	0	------	0	0	0	0	0	0	0	0	11
South Dakota:											
Aberdeen	2	------	------	0	------	0	0	------	0	0	------
Sioux Falls	0	------	0	0	0	4	0	0	0	0	8
Nebraska:											
Omaha	0	------	0	1	4	3	0	2	0	2	56
Kansas:											
Lawrence	0	2	0	0	0	0	0	0	0	0	5
Topeka	0	------	0	2	0	4	0	0	0	0	8
Wichita	0	------	0	44	2	2	0	0	0	0	29
Delaware:											
Wilmington	0	------	0	3	5	2	0	0	0	2	31
Maryland:											
Baltimore	0	6	2	0	32	6	0	10	1	44	237
Cumberland	0	------	0	0	1	2	0	0	1	0	11
Frederick	0	------	0	0	1	0	0	0	0	0	3
District of Columbia:											
Washington	1	1	1	2	8	10	0	10	1	7	161
Virginia:											
Lynchburg	1	------	0	0	1	2	0	1	0	3	16
Richmond	1	------	1	24	7	4	0	2	2	2	56
Roanoke	0	------	0	0	0	3	0	0	0	0	15
West Virginia:											
Charleston	0	------	0	0	3	0	0	1	0	0	12
Huntington	0	------	------	0	------	0	0	------	0	0	------
Wheeling	0	------	0	1	3	4	0	0	0	3	30
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	3	1	0	0	0	0	10
Wilmington	0	------	0	0	2	0	0	0	0	0	14
Winston-Salem	0	------	0	1	0	2	0	0	0	0	23
South Carolina:											
Charleston	0	15	1	0	1	2	0	1	0	0	20
Florence	0	5	2	0	2	0	0	0	0	0	15
Greenville	0	------	0	0	2	0	0	0	0	2	25

See footnotes at end of table.

City reports for week ended December 23, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Georgia:											
Atlanta	2	34	2	7	0	11	0	3	0	0	71
Brunswick	0	------	0	0	0	0	0	0	0	0	1
Savannah	0	23	2	0	3	4	0	2	0	0	40
Florida:											
Miami	0	3	1	0	2	0	0	5	0	0	42
Tampa	0	------	0	0	2	3	0	0	0	0	32
Kentucky:											
Ashland	1	------	0	0	4	0	0	0	0	0	5
Covington	0	------	0	0	1	1	0	0	0	0	12
Lexington	0	------	0	0	1	4	0	1	0	0	18
Tennessee:											
Knoxville	0	2	1	1	3	8	0	0	0	1	17
Memphis	0	------	0	2	6	10	0	3	0	8	66
Nashville	1	------	3	2	1	0	0	1	0	4	50
Alabama:											
Birmingham	2	69	4	0	3	9	0	2	0	1	55
Mobile	0	8	1	0	2	3	0	0	0	0	32
Montgomery	1	------	------	3	------	1	0	------	0	0	------
Arkansas:											
Fort Smith	0	1	------	0	------	0	0	------	0	------	------
Little Rock	2	------	0	0	6	0	0	1	0	0	26
Louisiana:											
Lake Charles	1	------	0	0	1	0	0	0	0	0	4
New Orleans	1	1	2	0	15	6	0	10	0	28	145
Shreveport	0	------	0	0	6	0	0	1	0	1	40
Oklahoma:											
Oklahoma City	0	1	0	1	5	0	0	1	0	0	45
Tulsa	1	------	------	0	------	0	0	------	0	2	------
Texas:											
Dallas	------	------	------	------	------	------	------	------	------	------	------
Fort Worth	0	------	0	0	3	5	0	0	1	7	37
Galveston	0	------	0	0	1	0	0	0	0	0	10
Houston	3	------	2	0	13	3	2	5	0	1	97
San Antonio	3	------	0	33	5	0	0	9	0	0	64
Montana:											
Billings	0	------	0	0	2	0	0	0	0	0	7
Great Falls	0	------	0	0	1	1	0	0	0	0	14
Helena	0	------	0	2	0	0	0	0	0	0	3
Missoula	0	------	0	1	0	0	0	0	0	3	3
Idaho:											
Boise	0	------	0	0	1	0	0	1	0	0	12
Colorado:											
Colorado Springs	0	------	0	0	0	1	0	0	0	0	15
Denver	8	------	1	0	9	10	0	0	0	2	80
Pueblo	0	------	0	0	2	0	0	1	0	0	13
New Mexico:											
Albuquerque	0	------	0	0	0	3	0	2	0	0	10
Utah:											
Salt Lake City	0	------	1	15	3	7	2	1	0	11	37
Washington:											
Seattle	0	------	0	17	3	9	0	1	0	0	83
Spokane	0	------	0	5	1	0	0	0	0	2	26
Tacoma	0	------	0	157	1	5	0	0	0	0	26
Oregon:											
Portland	0	1	2	6	8	9	0	1	0	14	75
Salem	0	------	------	3	------	0	0	------	0	0	------
California:											
Los Angeles	2	11	0	5	14	18	0	14	1	24	324
Sacramento	2	2	0	1	2	3	0	0	0	0	21
San Francisco	1	------	0	0	7	10	0	7	1	12	172

City reports for week ended December 23, 1939—Continued

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
New York:			
New York	1	0	0
Rochester	0	0	1
Pennsylvania:			
Philadelphia	1	0	0
Pittsburgh	1	0	0
Scranton	1	0	0
Ohio:			
Cleveland	2	0	0
Michigan:			
Detroit	0	0	1
Missouri:			
St. Joseph	1	0	0
Tennessee:			
Nashville	1	1	0
Alabama:			
Mobile	0	1	0
Louisiana:			
Shreveport	0	2	0
Montana:			
Billings	1	0	0
California:			
San Francisco	0	0	1

Encephalitis, epidemic or lethargic.—Cases: Newark, 1; Philadelphia, 1.
Pellagra.—Cases. Baltimore, 1; Savannah, 2; Birmingham, 1.
Typhus fever.—Cases: Atlanta, 2; Savannah, 3; Mobile, 1; Lake Charles, 1; New Orleans, 1; Galveston, 1; Houston, 1. Deaths: Mobile, 1.

FOREIGN REPORTS

CANADA

Vital statistics—Second quarter 1939.—The Bureau of Statistics of the Dominion of Canada has published the following preliminary statistics for the second quarter of 1939. The rates are computed on an annual basis. There were 20.8 live births per 1,000 population during the second quarter of 1939 as compared with 21.3 during the second quarter of 1938. The death rate was 9.8 per 1,000 population for the second quarter of 1939 and 9.6 per 1,000 population for the corresponding quarter of 1938. The infant mortality rate for the second quarter of 1939 was 60 per 1,000 live births and 62 per 1,000 live births for the same quarter of 1938. The maternal death rate was 4.6 per 1,000 live births for the second quarter of 1939 and 4.2 per 1,000 live births for the corresponding quarter of 1938.

The accompanying tables give the numbers of births, deaths, and marriages, by Provinces, for the second quarter of 1939, and deaths by causes in Canada for the second quarter of 1939 and the corresponding quarter of 1938:

Numbers of births, deaths, and marriages, second quarter 1939

Province	Live births	Deaths (exclusive of still-births)	Deaths under 1 year of age	Maternal deaths	Marriages
Canada [1]	58,468	27,505	3,522	271	23,097
Prince Edward Island	509	268	41	4	96
Nova Scotia	2,895	1,545	200	11	998
New Brunswick	2,938	1,204	192	12	822
Quebec	20,749	8,606	1,617	113	7,109
Ontario	16,364	9,586	762	81	8,112
Manitoba	3,477	1,507	183	9	1,534
Saskatchewan	4,500	1,453	239	15	1,212
Alberta	3,952	1,440	180	16	1,469
British Columbia	3,054	1,896	108	10	1,745

[1] Exclusive of Yukon and the Northwest Territories.

Deaths, by cause, second quarter 1939

Cause of death	Canada (second quarter)[1]		Province								
	1938	1939	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Automobile accidents	315	309	-------	17	14	68	152	11	9	13	25
Cancer	2,960	3,055	33	180	115	740	1,160	207	191	150	279
Cerebral hemorrhage, cerebral embolism, and thrombosis	479	517	10	52	41	117	198	17	35	19	28
Diarrhea and enteritis	501	445	2	10	17	263	71	25	23	22	12
Diphtheria	74	62	-------	6	3	44	3	2	4	-------	-------
Diseases of the arteries	2,584	2,763	22	128	112	556	1,364	136	113	137	195
Diseases of the heart	4,360	4,694	51	225	170	1,203	1,919	278	230	233	385
Homicides	38	27	-------	2	-------	4	13	1	-------	2	5
Influenza	559	1,198	14	93	32	388	422	58	82	66	43
Measles	67	74	-------	3	5	46	14	3	2	1	-------
Nephritis	1,728	1,703	18	86	40	773	513	46	73	61	93
Pneumonia	1,573	1,571	18	98	91	539	493	84	88	80	80
Poliomyelitis	11	12	-------	1	1	3	3	-------	1	2	1
Puerperal causes	247	271	4	11	12	113	81	9	15	16	10
Scarlet fever	44	40	-------	2	1	15	13	2	1	6	-------
Suicides	271	292	2	10	11	46	103	24	31	31	34
Tuberculosis	1,708	1,661	10	123	85	747	280	106	75	89	146
Typhoid and paratyphoid fever	39	47	-------	1	3	28	5	8	2	-------	-------
Unspecified or ill-defined causes	-------	138	8	11	34	46	15	2	3	11	8
Violent deaths	1,152	1,017	3	45	50	252	375	54	56	67	115
Other specified causes	-------	7,497	73	426	361	2,576	2,367	423	414	428	429
Whooping cough	130	112	-------	15	6	39	22	11	5	6	8

[1] Exclusive of Yukon and the Northwest Territories.

CUBA

Provinces—Notifiable diseases—4 weeks ended October 14, 1939.—During the 4 weeks ended October 14, 1939, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	4	1	2	6	1	8	22
Chickenpox	-------	-------	1	-------	-------	-------	1
Diphtheria	4	10	-------	1	-------	3	18
Hookworm disease	-------	-------	-------	1	-------	-------	1
Leprosy	-------	-------	-------	-------	-------	2	2
Malaria	31	22	-------	14	18	37	122
Measles	-------	-------	-------	-------	-------	7	7
Poliomyelitis	5	16	1	-------	-------	-------	22
Tuberculosis	14	60	23	60	20	32	209
Typhoid fever	24	81	12	85	10	105	217
Whooping cough	-------	-------	-------	-------	-------	1	1

ITALY

Communicable diseases—4 weeks ended October 8, 1939.—During the 4 weeks ended October 8, 1939, cases of certain communicable diseases were reported in Italy as follows:

	Sept. 11–17	Sept. 18–24	Sept. 25–Oct. 1	Oct. 2–8
Anthrax	13	34	26	14
Cerebrospinal meningitis	13	13	11	10
Chickenpox	73	61	44	51
Diphtheria	424	563	609	614
Dysentery (amoebic)	15	28	24	14
Dysentery (bacillary)	37	26	24	26
Hookworm disease	13	35	24	21
Lethargic encephalitis	1		1	2
Measles	178	147	147	185
Mumps	54	54	107	86
Paratyphoid fever	160	187	182	174
Pellagra	2	2	1	1
Poliomyelitis	163	167	164	155
Puerperal fever	23	18	35	32
Scarlet fever	156	194	167	203
Typhoid fever	872	951	1,002	1,011
Undulant fever	34	57	32	40
Whooping cough	223	200	217	227

SWITZERLAND

Communicable diseases—October 1939.—During the month of October 1939, cases of certain communicable diseases were reported in Switzerland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	2	Paratyphoid fever	4
Chickenpox	98	Poliomyelitis	110
Diphtheria	60	Scarlet fever	402
German measles	4	Tuberculosis	192
Influenza	5	Typhoid fever	2
Measles	141	Undulant fever	7
Mumps	45	Whooping cough	247

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases for a six-month period appeared in the PUBLIC HEALTH REPORTS of December 29, 1939, pages 2319–2333. A cumulative table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District.—On December 24, 1939, 1 human case of pneumonic plague was reported in Mauka Camp, Paauhau, Hamakua District, Island of Hawaii, T. H., the case being confirmed on December 30. A rat found on December 14, 1939, in Hamakua Mill area, and 1 rat found on December 11, 1939, in Paauhau area, Hamakua District, Island of Hawaii, T. H., have been proved positive for plague.

Typhus Fever

China—Tientsin.—During the week ended October 28, 1939, 2 cases of typhus fever were reported in Tientsin, China.

197640°

Public Health Reports

VOLUME 55 JANUARY 19, 1940 NUMBER 3

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

December 3–30, 1939

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the Public Health Reports under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended December 30, 1939, the number reported for the corresponding period in 1938, and the median number for the years 1934–38.

DISEASES ABOVE MEDIAN PREVALENCE

Influenza.—There was a sharp increase in the number of influenza cases from approximately 7,600 during the preceding 4-week period to 23,874 cases for the 4 weeks ended December 30. The number of cases was more than 3 times the number recorded for the corresponding period in 1938, which figure (7,736) also represents the 1934–38 average incidence for this period. The increase was clearly the sharpest in the South Atlantic, East South Central, and Mountain regions, although there were minor increases in the West North Central and Pacific regions. In the North Atlantic regions the incidence was about normal, while the East North Central reported a relatively low number of cases. A considerable increase in influenza usually occurs at this season of the year, but the rise during the current period was somewhat faster than is normally expected, the current incidence being the highest for this period in 7 years.

Poliomyelitis.—The incidence of poliomyelitis declined more than 50 percent during the 4 weeks ended December 30. Compared with recent years the number of cases (265) was about 3.5 times the number reported for the corresponding period in 1938 and more than 1.4 times the 1934–38 median figure for this period. In the East North Central region the number of cases was about normal, but all other regions reported a comparatively high incidence. The comparison of the cur-

rent incidence with that of 1938 was quite unfavorable, as there was no outbreak of this disease in any section of the country in that year, and, while the comparison with other epidemic years is more favorable, the current incidence is still relatively high, being the highest incidence since 1931 when 266 cases were reported for this period. Approximately 7,300 cases were reported for the year 1939, as compared with approximately 1,700 and 9,500 cases in 1938 and 1937, respectively.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period Dec. 3–30, 1939, the number for the corresponding period in 1938, and the median number of cases reported for the corresponding period 1934–38 [1]

Division	Current period	1938	5-year median	Current period	1938	5-year median	Current period	1938	5-year median	Current period	1938	5-year median
	Diphtheria			Influenza [2]			Measles [1]			Meningococcus meningitis		
United States [1]	2,355	2,788	3,031	23,874	7,736	7,736	11,035	18,196	18,196	132	158	317
New England	28	115	87	21	32	32	1,900	1,093	1,942	5	7	14
Middle Atlantic	271	349	355	118	90	115	1,936	3,429	3,429	40	25	54
East North Central	378	493	493	337	280	646	1,492	1,836	1,836	15	20	44
West North Central	135	206	229	542	300	316	876	3,617	3,617	6	10	27
South Atlantic	658	633	766	10,659	3,607	2,007	869	1,942	1,942	25	25	57
East South Central	298	246	367	2,950	803	823	264	324	324	17	30	37
West South Central	384	406	500	2,546	2,554	2,554	274	470	369	7	12	31
Mountain	88	128	90	5,978	851	354	629	1,389	857	8	19	12
Pacific	115	212	184	728	219	301	2,795	4,096	744	9	10	15
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States [1]	265	76	185	14,672	15,128	18,928	414	711	711	473	516	752
New England	10	2	2	717	817	1,054	0	0	0	18	7	24
Middle Atlantic	35	8	9	3,393	2,610	3,638	0	0	0	69	63	102
East North Central	23	7	25	4,702	5,524	6,339	48	210	99	68	78	78
West North Central	50	6	14	1,852	2,067	2,955	165	233	233	22	57	57
South Atlantic	24	17	17	1,364	993	1,246	4	3	5	89	90	152
East South Central	18	13	13	766	656	588	3	2	2	25	39	93
West South Central	21	12	12	442	767	725	57	88	32	115	128	128
Mountain	40	1	5	551	500	804	117	111	111	33	39	39
Pacific	44	10	34	885	1,194	1,221	20	64	146	34	15	46

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 44 States and New York City.
[3] 47 States. Mississippi is not included.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—For the 4 weeks ended December 30 there were 2,355 cases of diphtheria reported, as compared with 2,788, 2,551, and 3,031 cases for the corresponding period in 1938, 1937, and 1936, respectively. The South Atlantic and East South Central regions reported slight increases over the incidence in 1938, but the numbers of cases were lower than the 1934–38 average incidence for this period. In all other regions, except the Mountain, the incidence was not only lower than that in 1938, but it was also considerably below the average incidence for recent years.

Measles.—Reports indicated a continued increase in the number of cases of measles during the current period. However, compared with

recent years, the number of cases (11,035) was less than 60 percent of the 1938 figure for this period, as well as of the 1934–38 average incidence, which is represented by the 1938 figure (18,196 cases). The Pacific region reported an excess over the preceding 5-year average number of cases occurring in that region, but in all other regions the incidence was comparatively low.

Meningococcus meningitis.—The incidence of meningococcus meningitis also continued comparatively low in all sections of the country. For the 4 weeks ended December 30 there were 132 cases reported, which was the lowest number of cases reported for the corresponding period in the 11 years for which these data are available. The nearest approach to the current low incidence was in 1933, when there were 172 cases reported for this period.

Scarlet fever.—For the country as a whole, the number of cases (14,672) of scarlet fever, although showing the usual seasonal rise, was about 5 percent below the incidence reported for the corresponding period in 1938 and was about 20 percent below the 1934–38 average incidence for this period. A comparison of geographic regions shows that the disease was slightly above the normal seasonal expectancy in the South Atlantic and East South Central regions, but the other regions reported very significant decreases from the average incidence for recent years.

Smallpox.—For the current period there were 414 cases of smallpox reported, which figure is the lowest recorded for the corresponding period in the 11 years for which these data are available. Of the total cases, Colorado reported 107, Minnesota, 85, Iowa, 43, South Dakota and Oklahoma, 24 cases each. Almost 75 percent of the cases were reported from those 5 States. The largest number of cases of this disease is still reported from the Central and Western regions, the North Atlantic region being apparently free from the disease, and the South Atlantic region reporting a very small number of cases.

Typhoid fever.—The number of cases of typhoid fever (473) compared very favorably with the number (516) reported during the same period in 1938 and was about 65 percent of the 1934–38 average figure for the corresponding period. The incidence was comparatively low in all sections of the country, each section reporting a decline from the average incidence for recent years.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended December 30, based on data received from the Bureau of the Census, was 11.2 per 1,000 inhabitants (annual basis). The rate for this period in 1938 was 11.9, and the 1934–38 average rate was 12.2.

EPIDEMIC AND ENDEMIC TYPHUS: PROTECTIVE VALUE FOR GUINEA PIGS OF VACCINES PREPARED FROM INFECTED TISSUES OF THE DEVELOPING CHICK EMBRYO[1]

By HERALD R. COX, *Associate Bacteriologist*, and E. JOHN BELL, *Laboratory Assistant, United States Public Health Service*

Recently one of us reported the successful immunization of guinea pigs against Rocky Mountain spotted fever with vaccines prepared from infected tissues of the developing chick embryo (*1*). Similar satisfactory results, using essentially the same method, have been obtained with epidemic (European) typhus, and somewhat less conclusive results with endemic typhus.

MATERIALS AND METHODS

The Breinl strain of epidemic typhus virus and the Wilmington strain of endemic typhus virus, which had previously been carried through more than 60 consecutive passages in fertile eggs, were used.

In an earlier report (*2*) it was stated that rickettsiae of European (epidemic) typhus had not been observed in the yolk-sac, although the yolk-sac suspensions were typically pathogenic for guinea pigs. Since then, however, we have shown that rickettsiae of epidemic typhus are consistently found in numbers fully as great as in endemic typhus preparations (*3*).

In previous experiments (*2*) it was shown that in the case of certain rickettsial infections the yolk-sac has a higher limit of infectivity than other tissues of the developing chick. Thus, in order to obtain the greatest number of rickettsiae in proportion to the amount of extraneous protein present, 3 of the vaccines (ep. ty. 26 and 27 and en. ty. 28)[2] were prepared from only yolk-sac tissue. A fourth vaccine (ep. ty. 20) was prepared from the yolk-sac and chorio-allantois, while 3 others (ep. ty. 6–1, 6–2, and 6–3) were prepared from the pooled embryonic tissues (yolk-sac, chorio-allantois, and embryo).

Before inoculation, fertile eggs were incubated 6 to 7 days at 39° C. The inoculum, 0.5 to 1.0 cc. of a 10-percent yolk-sac suspension in Tyrode's-ascitic fluid, was injected into the yolk by means of a 1¼-inch, 21-gage needle introduced through the air-sac end of the egg. The eggs were then placed in a 37° C. incubator until death of the embryo, which usually occurred in 5 to 7 days. In every instance the tissues were used for vaccine preparation within 12 hours after death of the embryo.

Preparation of vaccines.—The embryonic tissue or tissues used were completely removed aseptically from a number of eggs of the same

[1] Contribution from the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

[2] Ep ty.=epidemic typhus, en. ty.=endemic typhus. The vaccine number represents the number of the serial passage of the typhus strain in eggs at the time the vaccine was prepared.

transfer and washed once or twice with sterile saline to remove any yolk or other fluids that might be present. They were then drained free of excess moisture, pooled, weighed, and ground with sterile alundum to a homogeneous mixture. Sterile saline was added to make a 10-percent suspension. A portion was reserved for titration and to the remainder was added phenol to 1.0-percent, and formalin to 0.5-percent concentration. The suspension was then vigorously shaken on a shaking machine for 1 hour and stored at 2° C. (6 to 76 days) before being refined for use.

Vaccines ep. ty. 26 and 27 and en. ty. 28 were similarly prepared from yolk-sac alone by the following method: The 10-percent suspension was allowed to stand at 2° C. for 6 days and was then centrifuged [3] at 4,500 to 5,000 r. p. m. for 45 minutes to an hour. The precipitate was reground with alundum, resuspended in approximately the same volume of saline,[4] and again centrifuged as above. This precipitate was also resuspended, this time in one-half the original volume of saline and then centrifuged at 1,000 r. p. m. for 10 minutes. The supernatant fluid thus obtained constituted the vaccine.

Practically all the lipoids along with some protein were eliminated in the first two supernatant fluids, while the great bulk of cellular debris was thrown down in the final precipitate. The final supernatant fluid, which constituted the vaccine, contained rickettsiae in profusion with relatively little detritus. Further clearing may be obtained by fractional centrifugation.

Vaccine ep. ty. 20 was similarly prepared except that it was made from yolk-sac and chorio-allantois and the crude suspension was kept at 2° C. for 25 days before being refined.

Vaccines ep. ty. 6–1, 6–2, and 6–3 were prepared somewhat differently. The crude suspension (yolk-sac, chorio-allantois, and embryo) was kept at 2° C. for 76 days and then treated as follows: A portion was diluted with saline (containing no phenol or formalin) to make a final tissue concentration of 2 percent. The suspension was centrifuged at 1,000 r. p. m. for 10 minutes and the supernatant fluid thus obtained constituted vaccine ep. ty. 6–1. The remaining portion of the crude suspension was diluted with saline (containing no phenol or formalin) to make a final tissue concentration of 4 percent. This suspension was centrifuged at 5,000 r. p. m. for 1 hour and the supernatant fluid thus obtained used as vaccine ep. ty. 6–2. The resulting precipitate was resuspended in one-fifth the original volume of saline (containing 0.4 percent phenol and 0.1 percent formalin), centrifuged at 1,000 r. p. m. for 10 minutes, and this supernatant fluid was used as vaccine ep. ty. 6–3

[3] A 51° angle centrifuge was used in all experiments.

[4] All saline used for resuspending the various vaccine fractions as well as that used in the final product contained phenol at 0.4-percent and formalin at 0.1-percent concentration.

TITRATION TESTS FOR INFECTIVITY OF EMBRYONIC TISSUE SUSPENSIONS

Titrations were made to determine the infective titers of the various suspensions used and to see whether differences found in immunizing powers might be related to the number of infectious doses in the source material. The procedure was as follows: The suspension was centrifuged (2,000 to 2,500 r. p. m. for 15 minutes) to throw down tissue fragments. The supernatant fluid was pipetted off, tenfold dilutions were prepared with a mixture containing equal volumes of ascitic fluid and Tyrode's solution, and each such dilution was tested by injecting guinea pigs intraperitoneally with 1 cc. each. All animals that survived were later tested for immunity.

Vaccine tests.—Guinea pigs received subcutaneously 1 cc. of vaccine either on one, two, or three occasions. If vaccine was injected more than once, the doses were given 6 or 7 days apart. Temperatures were taken daily throughout the period of immunization as well as through the period following the later test for immunity.

Fifteen to forty-four days after the last injection of vaccine the animals were tested for immunity by injecting each intraperitoneally with 1 cc. of inoculum. A suitable number of normal, control guinea pigs of the same weight always received the same inoculum. In addition, decimal dilutions of the inoculum were tested in other control guinea pigs to determine the approximate number of infectious doses given the vaccinated guinea pigs.

In testing for immunity to epidemic typhus the inoculum always consisted of a freshly prepared suspension of infected brain tissue taken from guinea pigs on the fourth or fifth day of fever. The brain tissues were ground with the aid of alundum and diluted to a 10 percent suspension with a mixture [5] containing equal volumes of ascitic fluid and Tyrode's solution. The suspension was then centrifuged at 1,800 to 2,000 r. p. m. for 10 minutes and the supernatant fluid pipetted off. This fluid, representing the 10^{-1} concentration of brain tissue, and the tenfold dilutions made from it were used as inocula.

Washings prepared on the third or fourth day of fever (second or third day of scrotal swelling) from the testicles and tunicae of guinea pigs were used in testing for immunity to endemic typhus. The testes and tunicae of 2 or more guinea pigs were removed aseptically and shaken with glass beads in an Erlenmeyer flask containing a suitable amount of fluid. The washings were then diluted to make a volume equal to 20 cc. for each testicle and tunica. The suspension was centrifuged at 1,800 to 2,000 r. p. m. for 10 minutes and the supernatant fluid pipetted off. The resulting supernatant fluid (called undiluted material) and the 10-fold dilutions were used as inocula.

[5] This mixture was employed in preparing all the infectious inocula used in the typhus tests.

Experimental data.—Titration tests showed that the infectivity end-points per gram of the embryonic tissues used in the preparation of the vaccines were remarkably high and uniform. Thus epidemic typhus vaccines ep. ty. 6–1, 6–2, 6–3 (all prepared from the same source material), 20, and 26, and endemic typhus vaccine en. ty. 28 all showed the limit of infectivity in a dilution of 1:100 million (10^{-8}), while epidemic typhus vaccine ep. ty. 27 was active in a dilution of 1:1 billion (10^{-9}).

Table 1 summarizes the data obtained in the three experiments with the six epidemic typhus vaccines.

TABLE 1.—*Tests of vaccinated guinea pigs for protection against epidemic typhus*

Immunization					Test for immunity								
					Dilution of infectious inoculum		Number of guinea pigs						
							Showing fever of 39.7° C. or above						
Experiment number	Vaccine lot number	Age of vaccine (days)	Dosage	Interval between vaccination and test for immunity (days)	Untreated controls	Test animals	1 day	2 days	3 days	More than 3 days	Showing scrotal swelling	Fully protected, no fever shown	Showing typical typhus
1	Ep. ty. 6-1	77	1 cc. twice	23		10^{-1}	1 of 4	0 of 4	0 of 4	0 of 4	0 of 4	3 of 4	0 of 4
	Ep. ty. 6-2	77	do	23		10^{-1}	0 of 4	0 of 4	0 of 4	0 of 4	0 of 1	4 of 4	0 of 4
	Ep. ty. 6-3	77	do	23		10^{-1}	1 of 5	1 of 5	0 of 5	0 of 5	0 of 5	3 of 5	0 of 5
					10^{-1}					4 of 4	1 of 4		4 of 4
					10^{-2}					3 of 4	0 of 4		3 of 4
					10^{-3}		0 of 4	0 of 4	0 of 4	0 of 4	0 of 4		0 of 4
2	Ep. ty. 6-1	77	1 cc. twice	44		10^{-1}	0 of 5	0 of 5	0 of 5	0 of 5	0 of 5	5 of 5	0 of 5
	do	77	do	44		10^{-2}	0 of 5	1 of 5	0 of 5	0 of 5	0 of 5	4 of 5	0 of 5
	Ep. ty. 6-2	77	do	44		10^{-1}	0 of 5	0 of 5	0 of 5	0 of 5	0 of 5	5 of 5	0 of 5
	do	77	do	44		10^{-2}	0 of 3	0 of 3	0 of 3	0 of 3	0 of 3	3 of 3	0 of 3
	Ep. ty. 6-3	77	do	44		10^{-1}	0 of 5	0 of 5	0 of 5	0 of 5	0 of 5	5 of 5	0 of 5
	do	77	do	44		10^{-2}	0 of 3	0 of 3	0 of 3	0 of 3	0 of 3	3 of 3	0 of 3
	Ep. ty. 20	27	1 cc. thrice	16		10^{-1}	1 of 8	0 of 8	0 of 8	0 of 8	0 of 8	7 of 8	0 of 8
	do	27	do	16		10^{-2}	0 of 6	0 of 6	0 of 6	0 of 6	0 of 6	6 of 6	0 of 6
					10^{-1}					4 of 4	1 of 4		4 of 4
					10^{-2}				1 of 4	3 of 4	0 of 4		3 of 4
					10^{-3}					4 of 4	0 of 4		4 of 4
					10^{-4}		0 of 1	0 of 4	1 of 4	1 of 4	0 of 4		1 of 4
					10^{-5}		0 of 4	0 of 4	0 of 4	0 of 4	0 of 4		0 of 4
					10^{-6}		0 of 4	0 of 4	0 of 4	0 of 4	0 of 4		0 of 4
3	Ep. ty. 26	10	1 cc. thrice	20		10^{-1}	4 of 8	1 of 8	0 of 8	0 of 8	0 of 8	3 of 8	0 of 8
	do	10	do	20		10^{-2}	1 of 8	0 of 8	0 of 8	0 of 8	0 of 8	7 of 8	0 of 3
	Ep. ty. 27	20	1 cc. once	20		10^{-1}	1 of 7	3 of 7	0 of 7	0 of 7	0 of 7	3 of 7	0 of 7
	do	20	do	20		10^{-2}	2 of 6	1 of 6	0 of 6	0 of 6	0 of 6	3 of 6	0 of 6
	do	14	1 cc. twice	20		10^{-1}	1 of 6	1 of 6	0 of 6	0 of 6	0 of 6	4 of 6	0 of 6
	do	14	do	20		10^{-2}	2 of 6	0 of 6	0 of 6	0 of 6	0 of 6	4 of 6	0 of 6
	do	8	1 cc. thrice	20		10^{-1}	2 of 6	0 of 6	0 of 6	0 of 6	0 of 6	4 of 6	0 of 6
	do	8	do	20		10^{-2}	0 of 6	0 of 6	0 of 6	0 of 6	0 of 6	6 of 6	0 of 6
					10^{-1}					5 of 5	0 of 5		5 of 5
					10^{-2}				1 of 5	4 of 5	0 of 5		4 of 5
					10^{-3}					5 of 5	0 of 5		5 of 5
					10^{-4}					2 of 5	0 of 5		2 of 5
					10^{-5}					0 of 5	0 of 5		0 of 5

The table shows that all epidemic typhus vaccines were potent and that complete protection was apparently afforded to 82 of the 106 vaccinated guinea pigs. Of the remaining 24 animals, 16 had only 1 day of fever while 8 had 2 days; 8 had a maximum temperature of

39.7°, 5 of 39.8°, 4 of 40.0°, 2 of 40.2°, and 5 of 40.4° C. Three of the vaccines, 6–1, 6–2, and 6–3, had been stored in the cold for 77 days before use.

The experiments recorded above clearly show that a high degree of active immunity may be induced in guinea pigs against epidemic typhus by use of killed vaccines prepared from infected tissues of developing chick embryos. Similar results have been achieved with rickettsial vaccines prepared against Rocky Mountain spotted fever (*1*).

Table 2 summarizes the data obtained in a single test made with the one endemic typhus vaccine.

TABLE 2.—*Test of vaccinated guinea pigs for protection against endemic typhus*

Immunization				Test for immunity								
				Dilutions of infectious inoculum		Number of guinea pigs						
						Showing fever of 39.7° C. or above						
Vaccine lot number	Age of vaccine (days)	Dosage	Interval between vaccination and test for immunity (days)	Untreated controls	Test animals	1 day	2 days	3 days	More than 3 days	Showing scrotal swelling	Fully protected, no fever shown	Showing typical typhus
En. ty. 28	12	1 cc. thrice	15		([1])	3 of 4	0 of 4	0 of 4	0 of 4	0 of 4	1 of 4	0 of 4
Do	12	do	15		10^{-1}	2 of 4	0 of 4	0 of 4	0 of 4	0 of 4	2 of 4	0 of 4
Do	12	do	15		10^{-2}	0 of 4	2 of 4	0 of 4	1 of 4	1 of 4	1 of 4	1 of 4
Do	18	1 cc. twice	15		([1])	2 of 4	0 of 4	0 of 4	0 of 4	0 of 4	2 of 4	0 of 4
Do	18	do	15		10^{-1}	1 of 4	1 of 4	0 of 4	0 of 4	0 of 4	2 of 4	0 of 4
Do	18	do	15		10^{-2}	1 of 4	1 of 4	0 of 4	0 of 4	0 of 4	2 of 4	0 of 4
Do	25	1 cc. once	15		([1])	2 of 4	1 of 4	0 of 4	0 of 4	0 of 4	1 of 4	0 of 4
Do	25	do	15		10^{-1}	2 of 4	0 of 4	0 of 4	0 of 4	0 of 4	2 of 4	0 of 4
Do	25	do	15		10^{-2}	2 of 4	0 of 4	0 of 4	0 of 4	0 of 4	2 of 4	0 of 4
				([1])					4 of 4	4 of 4		4 of 4
				10^{-1}					3 of 4	3 of 4		3 of 4
				10^{-2}				2 of 4	2 of 4	4 of 4		4 of 4
				10^{-3}					2 of 2	2 of 2		2 of 2
				10^{-4}					2 of 2	2 of 2		2 of 2

[1] Undiluted.

In the case of the single endemic typhus vaccine tested, the table shows that complete protection was afforded to 15 of the 36 vaccinated guinea pigs. Of the remaining 21 animals, 15 had only 1 day of fever, 5 had 2 days, and 1 had 5 days. This latter animal was the only one that showed scrotal swelling and a temperature curve typical of endemic typhus.

Of the 20 animals showing 1 or 2 days of fever, 6 had a maximum temperature of 39.7°, 7 of 39.8°, 3 of 40.0°, and 4 of 40.2° C.

Although the results obtained with the endemic typhus vaccine were not as satisfactory as those with the epidemic vaccine, they indicate that some active immunity was produced.

The quantity of vaccine obtained by the various methods of preparation described here varied considerably, but it is believed that any one of these methods would be found practical from the standpoint of quantity production. Thus, if all the embryonic tissues were used, the material obtained from 2 infected eggs would be sufficient to make at least 550 cc. of vaccine ep. ty. 6–1, 275 cc. of vaccine ep. ty. 6–2 or 50 to 60 cc. of vaccine ep. ty. 6–3. Similarly, 220 cc. of vaccine ep. ty. 20 were prepared from 14 eggs (only the yolk-sac and chorio-allantois were used) while 85 to 100 cc. of vaccine were obtained from 14 eggs by making vaccines such as ep. ty. 26 and 27 and en. ty. 28, in which the yolk-sac tissue alone was used. These latter vaccines, while giving a lesser yield in volume, possibly possess an advantage in that they may be more readily refined to contain a greater number of rickettsiae in proportion to the amount of extraneous protein present.

CONCLUSIONS

Vaccines that will protect most of the test guinea pigs against epidemic (European) typhus have been prepared from infected tissues of developing chick embryos. A similarly prepared vaccine against endemic typhus was not as efficient in protecting the guinea pigs, although it apparently did produce some active immunity.

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THE PATHOLOGY OF POLIOMYELITIS EXPERIMENTALLY INDUCED IN THE EASTERN COTTON RAT, *SIGMODON HISPIDUS HISPIDUS*[1]

By R. D. Lillie, *Surgeon*, and Charles Armstrong, *Senior Surgeon, United States Public Health Service*

The following is a report of the pathologic findings in the cotton rats used in Armstrong's (*1*) recently reported study of poliomyelitis in this species. A total of 31 animals was studied. Of these, 6 were excluded, 2 because of lack of lesions and failure to recover the virus, and 4 because of intercurrent infections. Table 1 lists the 31 cotton rats with the sources of inoculum and further transmission of the virus from them.

[1] From the Divisions of Pathology and Infectious Diseases, National Institute of Health.

TABLE 1.—*Inocula, passage generation, virus recovery, and pathology in cotton rats*

Cotton rat passage generation	Day died	Cotton rat number	Pathology number	Source of inoculum	Recovery of virus on subinoculation	Pathologic diagnosis	Remarks
1	26	1	12693	M R 341		Poliomyelitis	
1	9	9	13111	M R 325	Virus recovered, to C R 13	do	
1	8	27	14344	M. R. 538+L C M virus	L C M virus recovered	Lymphocytic choriomeningitis	Excluded
1	9	18	14534	M R 543	Virus not recovered	No lesions	Do
1	18	10	14660	M R 513	do	do	Do
1	15	C	15953	M R 852	Virus recovered, to C R C-2	Poliomyelitis	
2	21	8	13287	M R 8	Virus not recovered	do	
2	18	13	13166	C R 9	do	do	
2	60	17	14853	C R 28 polio+L C M virus	Not transferred	Lymphocytic meningitis	Do
2	7	30	14505	C R 28 polio+L C M virus		Lymphocytic chorio meningitis	Do
2	15	C-2	16032	C R "C"	Virus stored	Poliomyelitis	
2	10	25	16025	M R 363	Virus recovered, to C R 23	Encephalitis	
3	50	5	13429	C R 13	No paralysis, not transferred	Monocytic meningitis	Do
3	11	4	16087	C R 25	Died transfer died early	Poliomyelitis	
4	8	26-4	16115	C R 34	Died not transferred	do	
5	13	3	16204	C R 26	do	Encephalitis	
5	7	12	16170	C R -26	Virus recovered, to C R 1A	Poliomyelitis	
5	7	148	16171	C. R -26	Virus recovered to M R 601 and C R 153 [1]	do	
5	8	154	16202	C R 141	Not transferred	do	
6	8	1A	16214	C R 12	Virus recovered, to C R 190	do	
6	9	149	16215	C R 12	Not transferred	do	
6	7	153	16212	C R 148	Virus recovered, to C R 179	do	
7	6	179	16234	C R 153	Virus recovered, to C R 197	do	
7	11	190	16274	C R -1A	Killed 6th day sympt, virus not recovered	do	
8	7	197	16278	C R 179	Virus recovered, to C R 187	do	
8	12	198	16317	C R 179	Died, not transferred	do	
8	6	204	16275	C R 169	do	do	
8	6	206	16279	C R 169	Virus recovered, to C R 181	do	
9	6	181	16319	C R 206	Not transferred	do	
9	14	216	16356	C R 206	Died, not transferred	do	
10	9	244	16357	C R 181	do	do	

[1] M R 601, Path 16213, showed typical poliomyelitis on histologic study
M R = *Macacus rhesus* C R = cotton rat L C M = lymphocytic choriomeningitis.

Of the 25 rats used for the pathologic study, all showed focal lesions in some part of the brain and cord. These focal lesions are distributed much as in poliomyelitis in man and rhesus monkeys, showing fairly frequent but slight involvement of the frontal cortex, few lesions in other parts of the cerebral cortex, with more in the hippocampus, and increasing numbers of focal lesions in the brain stem from the corpora striata backward to the pons and medulla. Very slight involvement of the cerebellar cortex is seen, but moderate numbers of lesions are present in the cerebellar roof nuclei. Table 2 shows the distribution of the lesions. In regard to frequency and severity of cord lesions, this table is misleading to the extent that

FIGURE 1 —Cotton rat No 179, path No 16231 6 days Acute coagulation necrosis of nerve cells in the anterior horn of the spinal cord Romanowsky stain × 400

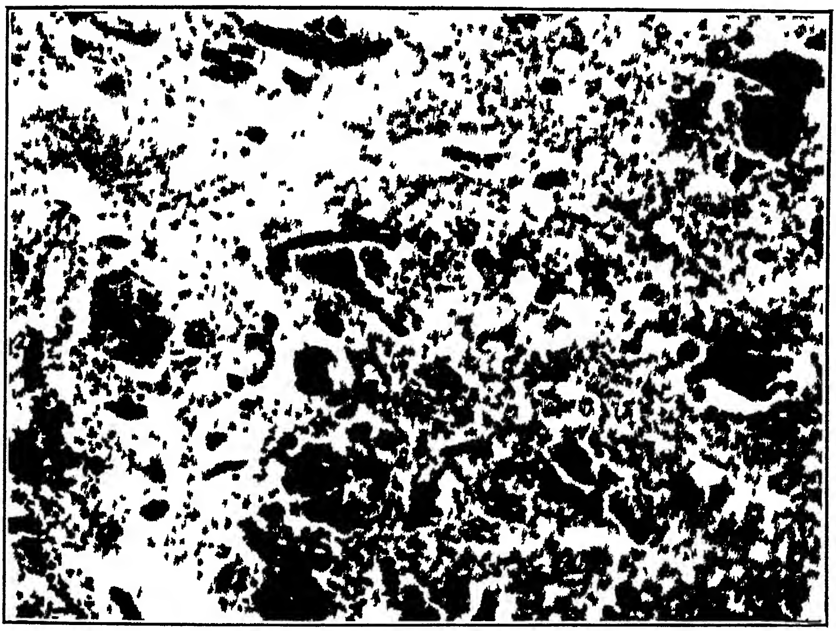

FIGURE 2 —Same as figure 1

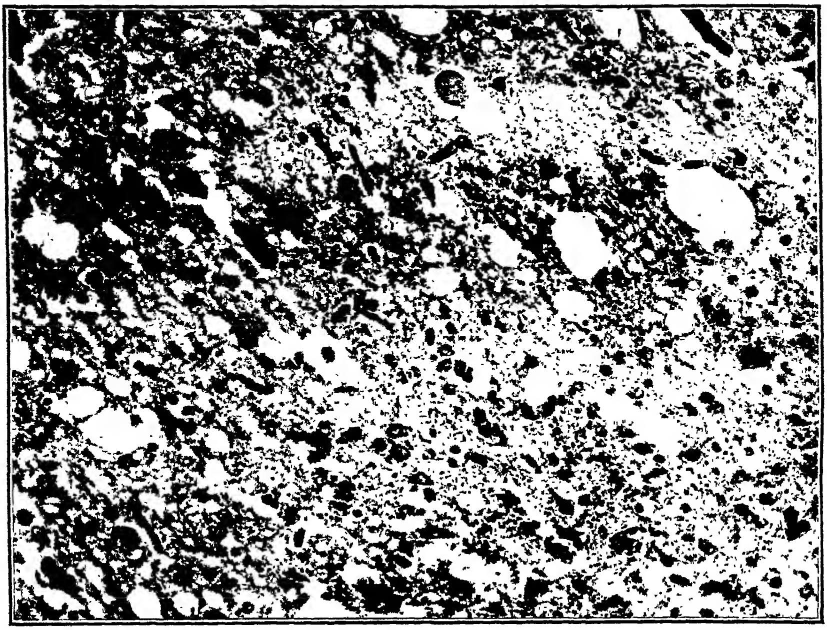

FIGURE 3.—Cotton rat No. 154, path. No. 16202, 8 days. Necrosis of nerve cells, pericellular vacuolation, and only occasional leucocytes in the anterior horn of the cord. × 267.

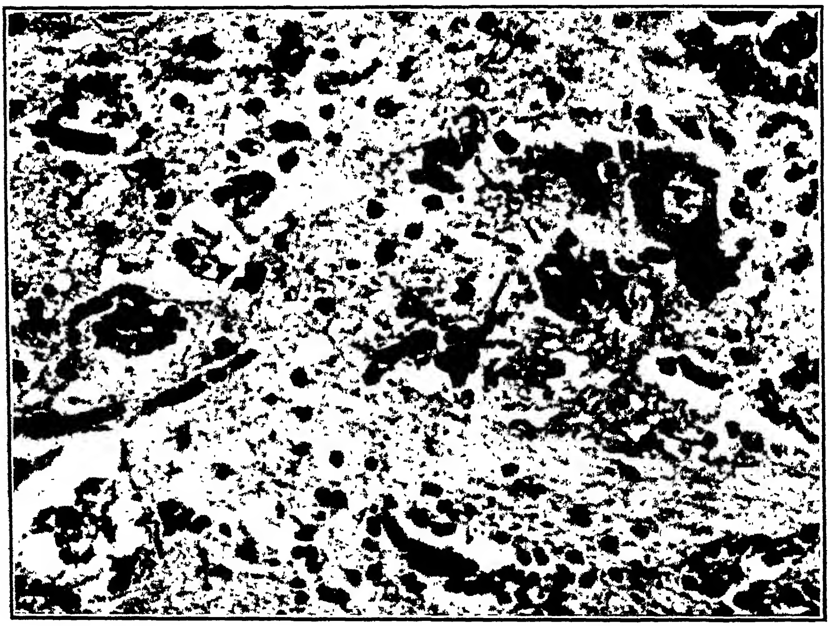

FIGURE 4.—Cotton rat No. 244, path. No. 16357, 9 days. Diffuse and focal polymorphonuclear infiltration and invasion of necrotic nerve cells, as well as pericellular vacuoles, necrotic cells, and pericapillary hemorrhage in the anterior horn of the spinal cord. × 400.

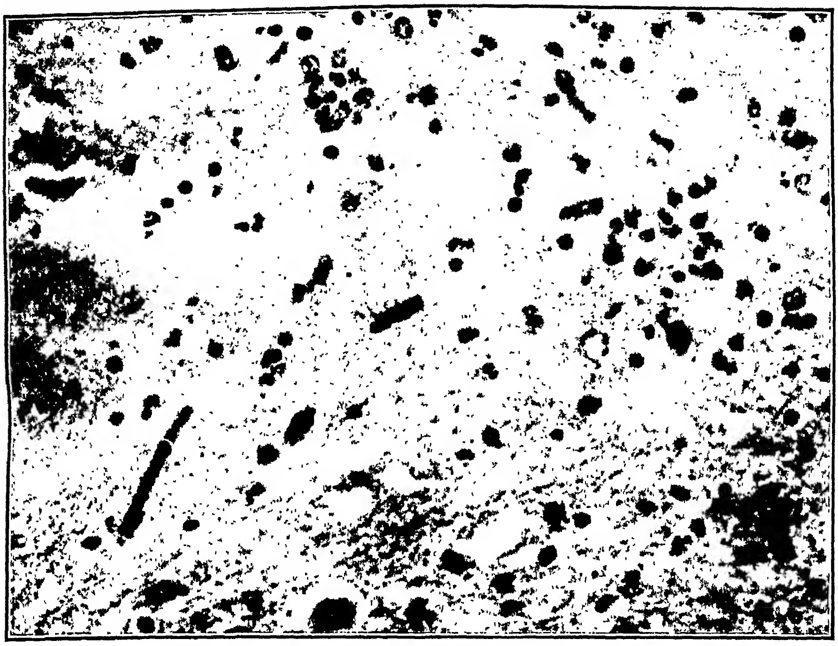

FIGURE 5.—Same as figure 4.

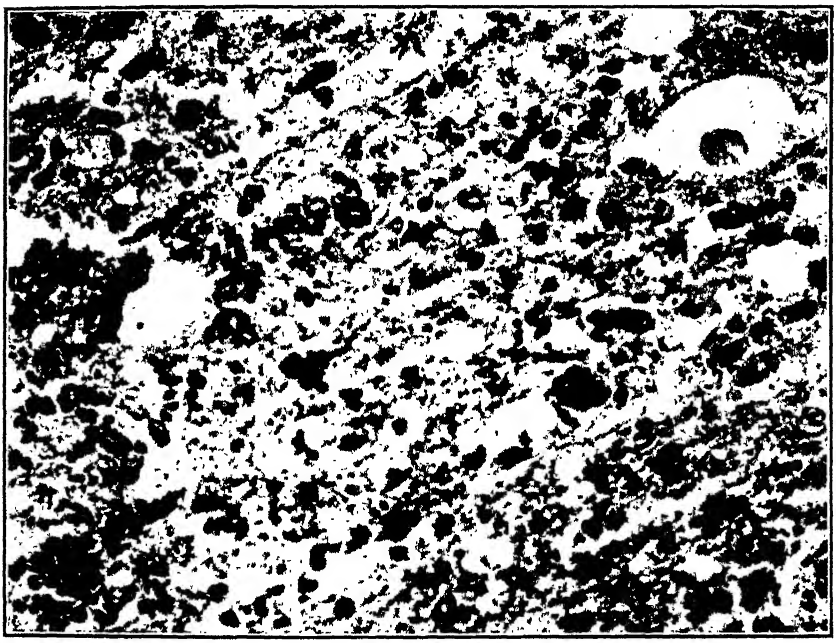

FIGURE 6.—Same as figures 4 and 5.

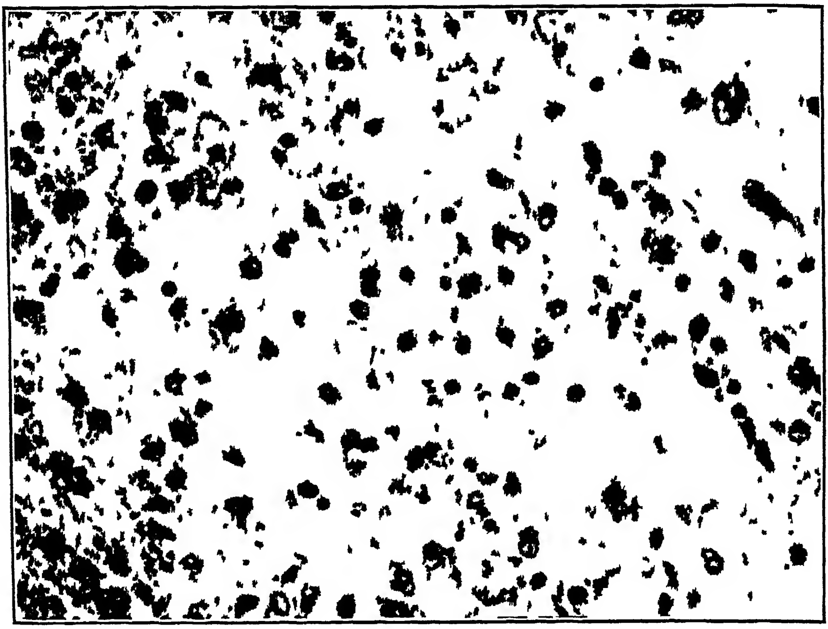

FIGURE 7—Cotton rat No 216 path No 16356 14 days An extensive macrophage infiltration, softening, and absence of nerve cells in the anterior horn of the spinal cord × 400

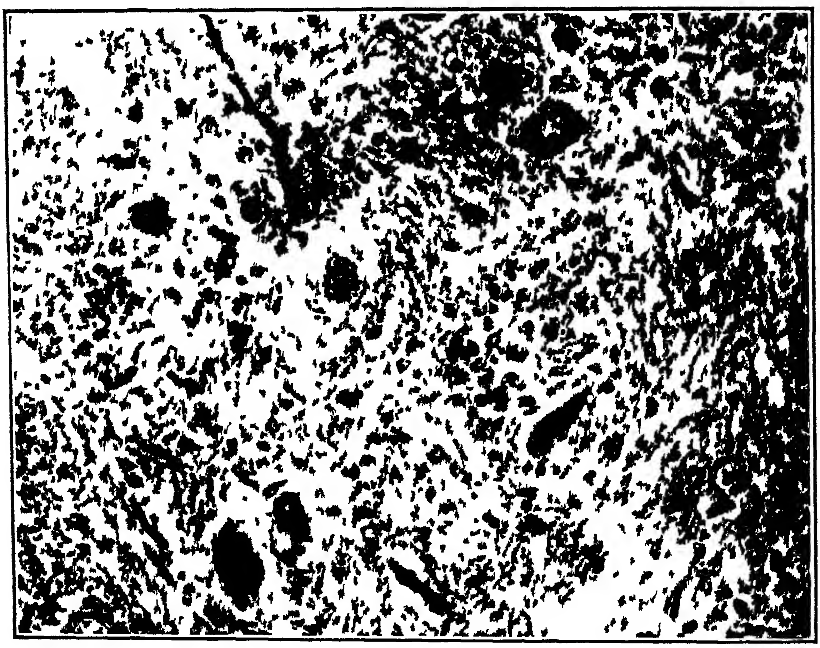

FIGURE 8—Cotton rat No 15, path No 13166 18 days Focal cellular gliosis replacing part of the anterior horn cells of the spinal cord × 267

presumably severely involved portions of the cord were taken for virus in a number of animals, and this fact may have operated to reduce the frequency of severe cord involvement in the material studied.

TABLE 2.—*Numbers of cotton rats and grades of reaction in various parts of the central nervous system*

Grade of involvement	Cerebral cortex					Brain stem and cerebellum							
	Frontal	Parietal	Temporal	Hippocampus	Occipital	Corpora striata	Thalamus	Midbrain	Pons	Roof nuclei	Cerebellar cortex	Medulla	Spinal cord
None	8	15	16	10	9	18	10	3	1	4	20	0	2
Slight	15	6	7	5	3	5	10	10	6	4	2	8	9
Moderate	1	2	0	7	2	2	3	8	15	10	1	10	7
Marked	1	1	1	2	0	0	0	3	2	0	0	0	4
Total	25	24	24	24	14	25	23	24	24	18	23	18	22

Cord lesions were present in all but 2 of the 22 animals in which spinal cord was saved for histologic study. Usually a few, occasionally more numerous, small vessels in gray and often white substance show sheath lymphocyte infiltration, endothelial swelling and proliferation, or both. Perivascular glia proliferation is rare. In about three-fourths of the animals few to numerous, often scattered, coagulated necrotic nerve cells with oxyphil cytoplasm and complete karyolysis are seen in the anterior horns. These are seen throughout the series, from 5 to 26 days after inoculation. Often there is no evident cellular reaction about them, and apparently they may disappear (by cytolysis?), leaving nothing behind but an apparent or perhaps quite evident diminution in nerve cell content of the gray substance. Up to 9 days after inoculation there is a quite frequent, more or less diffuse infiltration of the anterior horns by variable numbers of polymorphonuclear leucocytes. Not infrequently one or more leucocytes are seen invading the cytoplasm of necrotic cells, but the picture of a ring of leucocytes around the coagulated anterior horn cell which is so characteristic in man and monkeys has not thus far been seen in cotton rats. After the tenth day leucocytes are infrequent. Nodular and diffuse cellular gliosis is infrequent in the earlier stages, becoming more evident from about the eighth day on, and frequent after 11 days. Definite neuronophagia[2] is relatively infrequent even in the later stages, and absent before the eighth day. One cord section taken 14 days after inoculation showed replacement of one anterior horn by a mass of foam cells, with no remaining

[2] The term "neuronophagia" is reserved for pictures in which a coagulated nerve cell is still visible and is surrounded by macrophages.

neurons, although these were present in the contralateral anterior horn.

Cerebral cortical lesions were almost entirely vascular, with only few foci of cellular gliosis. Nerve cell necrosis in the hippocampus was noted in three cotton rats and was accompanied by more marked cellular gliosis, and in one by some polymorphonuclear leucocyte infiltration. This animal also showed similar changes in the adjacent parietal cortex, and while no inoculation wound was identified its proximity would seem indicated.

The corpora striata presented few lesions, almost all vascular, and, while lesions were more numerous in the thalamus, especially the hypothalamus, focal glia reactions remained infrequent.

Focal and patchy diffuse cellular gliosis became more frequent in the midbrain, tending to involve more the tegmental areas, substantia "nigra," red and oculomotor nuclei. Isolated necrotic nerve cells, sometimes in neuronophagia, were seen in three cotton rats, all in the red nuclei.

In the pons, lesions of all types became more numerous, focal and diffuse gliosis were more prominent, and necrotic nerve cells were often seen, particularly in trigeminus nuclei and tegmentum. Tectile nuclei were apparently more involved than dentate, as in man and monkeys, though these nuclei are less well separated in cotton rats. Both vascular lesions and focal and diffuse cellular gliosis were seen, but no nerve cell necrosis or neuronophagia was observed.

Only occasional foci of cellular gliosis in the molecular layer or vascular lesions were seen in the cerebellar cortex.

In the medulla, vascular lesions and focal and diffuse cellular gliosis were frequent, especially in the reticular substance, as in man and monkeys. Necrotic nerve cells were found in three animals, once in the nucleus dorsalis vagi, twice in the substantia reticularis.

Meninges commonly show some diffuse and perivascular infiltration, chiefly by lymphocytes.

Other organs were studied in more or less detail in eight cotton rats. No significant lesions were found in heart, testicle, pancreas, small intestine, adrenal, or liver. Kidneys in four rats were normal while four showed slight granular degeneration of convoluted tubules with albuminous exudate in their lumina. The spleens generally showed large follicles with germinal centers, mitoses, and perhaps phagocytosis of nuclear debris by the follicle cleft phagocytes. In the lungs, focal hemorrhage was present in two rats, slight edema in one, and no lesions in six. Femoral marrow was studied in three rats and in all showed active myelopoiesis with active maturation of polymorphonuclear leucocytes. Bladder, esophagus, stomach, colon, omentum,

salivary gland, larynx, and skeletal muscle were studied in one to three animals each, and showed no significant lesions.

SUMMARY

The virus of human poliomyelitis produces in the cotton rat, *Sigmodon hispidus hispidus*, a poliomyeloencephalitis which is closely similar in topographic distribution as well as in individual lesion types to that observed in man and *Macacus rhesus* with this virus. In the brain, medulla and pons show the greatest reaction, cerebellar roof nuclei and midbrain next. Nerve cell necrosis, polymorphonuclear infiltration and invasion of necrotic cells, neuronophagia, focal and diffuse cellular gliosis, and vascular endothelial swelling and proliferation and sheath lymphocyte infiltration are all observed.

Other organs show no important changes.

REFERENCE

(*1*) Armstrong, C.: The experimental transmission of poliomyelitis to the eastern cotton rat, *Sigmodon hispidus hispidus*. Pub. Health Rep., 54: 1719 (1939).

ANOPHELES WALKERI (THEOBALD): A WILD-CAUGHT SPECIMEN HARBORING MALARIAL PLASMODIA[1]

By F. B Bang, G. E. Quinby, and T. W. Simpson, *Scientific Assistants, United States Public Health Service*

Anopheles walkeri Theobald has for a number of years been under suspicion as a vector of malaria in the Reelfoot Lake region of Tennessee and Kentucky because of its prevalence and its tendency to bite man. It has been shown to be a laboratory vector of *Plasmodium vivax* (*1*) and *P. falciparum* (*2*). For this reason a series of salivary gland dissections from wild-caught adult mosquitoes was undertaken.

It has been the custom when carrying on dissections of anophelines to collect them either in their daytime resting place or as they come to bite at night. However, *A. walkeri* cannot be collected in very large numbers, for they tend to remain hidden deep in the swamps, sometimes on damp logs just over the water, but more frequently in thick growths of Cut Grass, *Zizianopsis miliacea*, and here can be collected only in small numbers. Even fewer numbers are found in damp barns, under bridges near the mud, and in springhouses. The best method of collection has always been the New Jersey light trap (*3*).

It was thought worth while to attempt to determine whether specimens obtained in light traps would be suitable for dissection; that is,

[1] From the Reelfoot Lake Biological Station.

to find out whether they had had any previous blood meals. Almost invariably females caught in light traps have thin, tapering abdomens.

At the suggestion of Dr. Mark F. Boyd, Station for Malaria Research, Tallahassee, Fla., a series of ovarian dissections was begun. It was found that the majority of the ovaries of light-trap-caught *A. walkeri* were in stage 2, that there was no blood in the gut; further, that there were a few individuals with ovaries in stage 2 with mature eggs retained from the previous oviposition. This was considered sufficient evidence that probably the majority of the specimens, and certainly a few of them, had had a previous blood meal.

On July 11, 1939, a series of dissections of light-trap material from the environs of Bondurant, Ky., was started. Dissections were carried on at night in temporary quarters and were continued on refrigerated specimens the following day in the laboratory at the Reelfoot Lake Biological Station. The heads of all specimens were kept on the slides until the examination was completed.

On July 29, 1939, the salivary glands of the 231st *A. walkeri* specimen which had been caught in a light trap were found to be heavily infected with about 150 motile sporozoites per high power field (fig. 1). The determination of the mosquito specimen was rechecked. The stomach was immediately dissected and six oocysts with heavy black blocks of pigment were found on the posterior portion of the stomach Several of these oocysts in "sunburst" stage had mature sporozoites (fig 2). Several other oocysts had ruptured and had discharged numerous sporozoites.

The slides were forwarded to Dr. Bruce Mayne at the malaria research laboratory of the Public Health Service at Columbia, S. C., where on the basis of comparative measurements the sporozoites were found to be indistinguishable from similar forms dissected from *A. quadrimaculatus* artificially infected with human malaria.

This evidence does not, of course, prove that the sporozoites are those of human malaria. However, when added to the fact that *A. walkeri* shows a definite preference for mammals, including man, rather than for birds, it indicates a human origin of the plasmodia.

REFERENCES

(*1*) Matheson, Robert, Boyd, Mark F., and Stratman-Thomas, Warren K *Anopheles walkeri* Theobald as a vector of *Plasmodium vivax*, Grassi and Feletti Am J Hyg, **17**: 515–516 (1933).

(*2*) Kitchen, S F, and Bradley, G H : *Anopheles walkeri* Theobald as a vector of *Plasmodium falciparum* (Welch) Am. J. Trop Med, **16**: 579–581 (1936).

(*3*) Johnson, H A.: Notes on the occurrence of *A walkeri* South Med. J, **29**: 856–857 (1936)

FIGURE 1

FIGURE 2

(Photographs by courtesy of Dr C L Baker)

REPORT ON MARKET-MILK SUPPLIES OF CERTAIN URBAN COMMUNITIES

Compliance of the Market-Milk Supplies of Certain Urban Communities With the Grade A Pasteurized and Grade A Raw Milk Requirements of the Public Health Service Milk Ordinance and Code, as Shown by Compliance (Not Safety) Ratings of 90 Percent or More Reported by the State Milk-Sanitation Authorities During the Period January 1, 1938, to December 31, 1939

The accompanying list gives the thirteenth semiannual revision of the list of certain urban communities in which the pasteurized market milk is both produced and pasteurized in accordance with the Grade A pasteurized milk requirements of the Public Health Service Milk Ordinance and Code and in which the raw market milk sold to the final consumer is produced in accordance with the Grade A raw milk requirements of said ordinance and code, as shown by ratings of 90 percent or more reported by State milk-sanitation authorities.

These ratings are not a complete measure of safety but represent the degree of compliance with the Grade A requirements of the Public Health Service Milk Ordinance and Code. Safety estimates should also take into account the percentage of milk pasteurized, which is given in the following tables.

The primary reason for publishing such lists from time to time is to encourage the communities of the United States to attain and maintain a high level of excellence in the public health control of milk supplies.

It is emphasized that the Public Health Service does not intend to imply that only those communities on the list are provided with high-grade milk supplies. Some communities which have high-grade milk supplies are not included because arrangements have not been made for the determination of their ratings by the State milk-sanitation authority. In other cases the ratings which have been determined are now more than 2 years old and have therefore lapsed. In still other communities with high-grade milk supplies there seems, in the opinion of the community, to be no local necessity nor desire for rating or inclusion in the list, nor any reasonable local benefit to be derived therefrom.

The rules under which a community is included in this list are as follows:

(1) All ratings must have been determined by the State milk-sanitation authority in accordance with the Public Health Service rating method (Pub. Health Rep., **53:** 1386 (1938). Reprint No. 1970), based upon the Grade A pasteurized milk and the Grade A raw milk requirements of the Public Health Service Milk Ordinance and Code.

(2) No community will be included in the list unless both its pasteurized milk and its raw milk ratings are 90 percent or more. Communities in which only raw milk is sold will be included if the raw milk ratings are 90 percent or more.

(3) The rating used will be the latest rating submitted to the Public Health Service, but no rating will be used which is more than 2 years old.

(4) The Public Health Service will make occasional check surveys of cities for which ratings of 90 percent or more have been reported by the State. If such check rating is less than 90 percent but not less than 85, the city will be removed from the 90-percent list after 6 months unless a resurvey submitted by the State during this probationary interim shows a rating of 90 percent or more. If, however, such check rating is less than 85 percent, the city will be removed from the list immediately. If the check rating is 90 percent or more, the city will be retained on the list for a period of 2 years from the date of the check survey unless a subsequent rating submitted during this period warrants its removal.

Communities are urgently advised to bring their ordinances up to date at least every 5 years, since ratings will be made on the basis of later editions if those adopted locally are more than 5 years old.

Communities which are not now on the list and desire to be rated should request the State milk-sanitation authority to determine their ratings and, if necessary, should improve their status sufficiently to merit inclusion in the list.

Communities which are now on the list should not permit their ratings to lapse, as ratings more than 2 years old cannot be used.

Communities which have not adopted the Public Health Service Milk Ordinance may wish to give thoughtful consideration to the advisability of doing so. It is obviously easier to satisfy the requirements upon which the rating method is based if these are included in the local legislation.

Communities which are enforcing the Public Health Service Milk Ordinance, but which have not yet been admitted to the list, should determine whether this has been the result of failure to enforce the ordinance strictly or failure to bring the ordinance up to date.

State milk-sanitation authorities which are not now equipped to determine municipal ratings are urged, in fairness to their communities, to equip themselves as soon as possible. The personnel required is small, as in most States one milk specialist is sufficient for the work.

The inclusion of a community in this list means that the pasteurized milk sold in the community, if any, is of such a degree of excellence that the weighted average of the percentages of compliance with the various items of sanitation required for Grade A pasteurized milk is 90 percent or more and that, similarly, the raw milk sold in the com-

munity, if any, so nearly meets the requirements that the weighted average of the percentages of compliance with the various items of sanitation required for Grade A raw milk is 90 percent or more. However, high-grade pasteurized milk is safer than high-grade raw milk, because of the added protection of pasteurization. To secure this added protection, those who are dependent on raw milk can pasteurize the milk at home in the following simple manner: Heat the milk over a hot flame to 155° F., stirring constantly; then immediately place the vessel in cold water and continue stirring until cool.

TABLE 1.—*Communities in which all market milk is pasteurized. In these communities market milk complies with the Grade A pasteurized milk requirements of the Public Health Service Milk Ordinance and Code to the extent shown by pasteurized milk ratings of 90 percent or more* [1]

Community	Percentage of milk pasteurized	Date of rating	Community	Percentage of milk pasteurized	Date of rating
ILLINOIS			MINNESOTA		
Elgin	100	Dec. 14, 1938.	Albert Lea	100	Sept. 29, 1938.
Evanston	100	May 10, 1938.	Rochester	100	October 1938
Glencoe	100	May 13, 1938	Winona	100	Aug. 12, 1938.
Highland Park	100	Do.	MISSOURI		
Kenilworth	100	Do.	St. Louis	100	June 1938.
Lake Bluff	100	Do.	NORTH CAROLINA		
Lake Forest	100	Do	Clinton	100	Aug. 18, 1939.
Waukegan	100	May 16, 1938.	Fort Bragg	100	Do.
Winnetka	100	May 13, 1938.	Tarboro	100	Nov. 1, 1938.

[1] Note particularly the percentage of milk pasteurized in the various communities listed in these tables. This percentage is an important factor to consider in estimating the safety of a city's milk supply.

TABLE 2.—*Communities in which some market milk is pasteurized. In these communities the pasteurized market milk complies with the Grade A pasteurized milk requirements and the raw market milk complies with the Grade A raw milk requirements of the Public Health Service Milk Ordinance and Code to the extent shown by pasteurized and raw milk ratings, respectively, of 90 percent or more* [1]

[NOTE.—All milk should be pasteurized or boiled, either commercially or at home, before it is consumed. See text for home method]

Community	Percentage of milk pasteurized	Date of rating
ALABAMA		
Dothan	49	June 21, 1938.
Huntsville	80	Dec. 7, 1938.
Montgomery	27	Mar. 15, 1939.
ARKANSAS		
Fayetteville	59	May 1939.
Fort Smith	38	June 1939.
Jonesboro	37	May 1939.
Little Rock	49	October 1939.
Pine Bluff	28	June 1939.
Texarkana	35	Aug. 16, 1939.
FLORIDA		
Miami Beach	93	May 12, 1938.
GEORGIA		
Americus	13	June 21, 1939.
ILLINOIS		
Chicago	99.9	May 20, 1939.
Decatur	87	Jan. 28, 1939.
KANSAS		
Kansas City	51	December 1938.
Lawrence	61	January 1938.
Ottawa	13	Do.
Wichita	75	December 1939.
KENTUCKY		
Berea	1	November 1939.
Bowling Green	70	Dec. 22, 1939.
Glasgow	68	June 27, 1939.
Jefferson County	43	August 1939.
Louisville	97	July 1938.
Richmond	22	November 1939.
MINNESOTA		
Austin	77	May 19, 1938.
Little Falls	70	June 26, 1939.
MISSISSIPPI		
Greenville	58	May 25, 1939.
McComb	21	Dec. 6, 1938.
Tupelo	21	Jan. 6, 1939.
MISSOURI		
Clayton	99.9	June 1938.
Ferguson	80	Do.
Kirkwood	94	Do.
University City	99.6	Do.
Webster Groves	93	Do.
NEW MEXICO		
Albuquerque	69	Nov. 1939.
Las Vegas	65	July 25, 1939.
Roswell	77	Aug. 8, 1939.
NORTH CAROLINA		
Asheville	67	June 23, 1938.
Fayetteville	50	Aug. 18, 1939.
Franklin	85	July 19, 1939.
Greensboro	79	August 1939.
Hendersonville	53	Sept. 13, 1938.
Mount Airy	47	Oct. 18, 1938.
Reidsville	69	Aug. 18, 1938.
Rocky Mount	50	Nov. 29, 1938.
Salisbury	57	Oct. 6, 1938.
Tryon	49	July 24, 1939.
Winston-Salem	61	November 1938.
NORTH DAKOTA		
Valley City	23	Nov. 10, 1939.
OHIO		
Athens	84	Oct. 6, 1938.
OKLAHOMA		
Ada	62	Sept. 16, 1938.
Bartlesville	45	Dec. 19, 1939.
Blackwell	35	Nov. 28, 1939.
Lawton	47	Feb. 22, 1939.
Muskogee	59	Nov. 10, 1939.
Oklahoma City	73	Mar. 29, 1939.
Okmulgee	61	Nov. 8, 1939.
Tulsa	74	April 1939
OREGON		
Astoria	64	June 16, 1939.
Portland	80	July 2, 1938
SOUTH CAROLINA		
Walterboro	26	Dec. 6, 1939.
TENNESSEE		
Bristol	69	July 14, 1939.
Clinton	75	June 9, 1938.
TEXAS		
Abilene	67	Apr. 25, 1939.
Amarillo	78	Oct. 17, 1938.
Ballinger	49	Apr. 21, 1939.
Big Spring	34	Sept. 20 1938.
Corpus Christi	87	May 26, 1939.
Dallas	77	Dec. 10, 1938.
Fort Worth	75	Feb. 25, 1939.
Gainesville	63	June 30, 1939.
Henderson	50	Nov. 25, 1939.
Kerrville	74	Sept. 6, 1939.
Lamesa	48	May 4, 1939.
Lubbock	76	Oct. 28, 1939.
Seguin	12	July 30, 1938.
Sherman	43	June 17 1939.
Texarkana	26	Aug 16, 1939.
Tyler	49	Apr 14, 1939.
Waco	48	Mar. 30, 1939.
UTAH		
Salt Lake City	96	Mar. 31, 1938.
VIRGINIA		
Bristol	69	July 14, 1939.
Lexington	41	Oct. 26, 1939.
Pulaski	77	Sept. 20, 1939.
South Boston	72	Sept. 22, 1939.
Waynesboro	95	Oct. 11, 1939.
Williamsburg	41	May 3, 1939.
WASHINGTON		
Camas	8	May 22, 1939
Vancouver	31	May 25, 1939.
Walla Walla	53	Apr. 14, 1939.
Yakima	67	Apr. 20, 1939.
WEST VIRGINIA		
Huntington	66	June 5, 1939.
WYOMING		
Casper	71	Aug. 17, 1938.
Cheyenne	74	July 7, 1938.

[1] Note particularly the percentage of milk pasteurized in the various communities listed in these tables. This percentage is an important factor to consider in estimating the safety of a city's milk supply.

TABLE 3.—*Communities in which no market milk is pasteurized, but in which the raw market milk complies with the grade A raw milk requirements of the Public Health Service Milk Ordinance and Code to the extent shown by raw milk ratings of 90 percent or more* [1]

[NOTE.—All milk should be pasteurized or boiled, either commercially or at home, before it is consumed. See text for home method]

Community	Date of rating
KENTUCKY	
Somerset	November 1939.
MISSISSIPPI	
Canton	Oct. 17, 1938.
Greenwood	Nov. 22, 1938.
Hollandale	Nov. 30, 1938.
Holly Springs	Jan. 4, 1939.
Leland	Nov. 30, 1938.
Magnolia	Dec. 6, 1938.
Yazoo City	Oct. 12, 1938.
NORTH CAROLINA	
Ahoskie	Oct. 20, 1938.
Aulander	Nov. 8, 1938.
Belhaven	Oct. 26, 1938.
Bladenboro	Aug. 23, 1939.
Brevard	July 28, 1939.
Clarkton	Aug. 23, 1939.
Colerain	Nov. 8, 1938.
Dunn	July 6, 1939.
Edenton	Nov. 7, 1938.
Elkin	Sept. 18, 1939.
Fremont	Feb. 2, 1938.
Hope Mills	Aug. 18, 1939.
Kelford	Nov. 8, 1938.
Lewiston	Do.
Mars Hill	Feb. 21, 1939
Mount Olive	Aug. 22, 1939.
Murfreesboro	Oct. [illegible], 1938.
North Wilkesboro	July [illegible], 1938.
Pilot Mountain	Sept. [illegible], 1939.
Powellsville	Nov. 8, 1938.
NORTH CAROLINA—continued	
Roxobel	Nov. 8, 1938.
Wilkesboro	July 29, 1938.
Windsor	Nov. 8, 1938.
Woodville	Do.
OKLAHOMA	
Hobart	Jan. 19, 1938.
SOUTH CAROLINA	
Hartsville	Nov. 9, 1939
TENNESSEE	
Knox County	June 7, 1938.
Savannah	Apr. 22, 1938.
TEXAS	
Canyon	Oct. 14, 1938.
Colorado	Nov. 3, 1939.
Commerce	Mar. 16, 1939.
Del Rio	Apr. 20, 1939.
Kermit	Sept. 12, 1938.
VIRGINIA	
Blackstone	Nov. 2, 1939.
Boydton	Apr. 26, 1939.
WEST VIRGINIA	
Grantsville	June 7, 1939.

[1] Note particularly the percentage of milk pasteurized in the various communities listed in these tables This percentage is an important factor to consider in estimating the safety of a city's milk supply.

DEATHS DURING WEEK ENDED DECEMBER 30, 1939

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Dec. 30, 1939	Corresponding week, 1938
Data from 88 large cities of the United States:		
Total deaths	8,901	9,178
Average for 3 prior years	[1] 9,757	
Total deaths, 52 weeks of year	429,419	424,348
Deaths under 1 year of age	465	485
Average for 3 prior years	[1] 573	
Deaths under 1 year of age, 52 weeks of year	25,713	27,159
Data from industrial insurance companies:		
Policies in force	66,393,376	68,321,330
Number of death claims	10,624	10,406
Death claims per 1,000 policies in force, annual rate	8.3	7.9
Death claims per 1,000 policies, 52 weeks of year, annual rate	9.8	9.2

[1] Data for 86 cities.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JANUARY 13, 1940

Summary

Influenza continued its rise during the current week, as was to be expected, with 12,516 cases reported, as compared with 9,630 cases for the preceding week and with 3,018 cases for the corresponding median week of the 5-year period 1935–39. The highest incidence is still shown in the South Atlantic and South Central areas, where 6 States reported 9,902 cases, or nearly 80 percent of the total for the week. The plotted curve shows a much earlier and sharper rise in the disease this winter than that for either last year or the 5-year median.

While the figures for all of the other 8 important communicable diseases, with the exception of typhoid fever and poliomyelitis, showed slight increases from the preceding week, all were below the median expectancy except poliomyelitis. The total number of cases for poliomyelitis reported was 42, as compared with 43 for the preceding week and with 22 for the 5-year median. Only 3 States reported more than 2 cases, however. The largest number of cases and the largest increase is shown for California, where 16 cases were reported as compared with 8 cases for the preceding week.

Maryland reported 5 cases of tularaemia, and the South Atlantic and South Central States reported 39 cases of endemic typhus fever, as compared with 24 cases for the preceding week. The incidence of smallpox and typhoid fever remained low as compared with the median expectancy. Of the 110 cases of smallpox reported, 77 cases, or 70 percent, occurred in three States—Minnesota, Iowa, and Colorado.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 13, 1940, and comparison with corresponding week of 1939 and 5-year median

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

In these and the following tables, a zero (0) indicates a positive report and has the same significance as any other figure, while leaders (------) represent no report with the implication that cases or deaths may have occurred but were not reported to the State health officer.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939	
NEW ENG.												
Maine	4	13	3	32	3	5	73	34	66	0	0	0
New Hampshire	0	0	0	------	------	------	12	1	24	0	0	0
Vermont	0	0	0	------	------	------	3	11	11	0	0	0
Massachusetts	9	3	7	------	------	------	185	441	287	1	1	1
Rhode Island	0	1	0	------	------	------	226	5	13	1	0	0
Connecticut	0	2	4	3	6	10	161	184	184	1	0	0
MID. ATL.												
New York	25	37	43	[1] 13	[1] 57	[1] 52	369	1,338	971	1	10	10
New Jersey	7	13	18	18	24	24	23	22	66	0	0	3
Pennsylvania	28	33	64	------	------	------	50	109	365	9	1	4
E. NO. CEN.												
Ohio	28	33	45	88	------	14	22	24	73	0	1	6
Indiana	14	29	51	25	11	39	7	9	12	1	0	3
Illinois	41	65	45	36	12	57	33	48	57	0	0	7
Michigan [2]	11	7	12	15	------	2	384	440	252	0	0	2
Wisconsin	2	1	4	48	65	35	221	471	471	0	1	2
W. NO. CEN.												
Minnesota	5	2	4	3	2	2	255	1,003	122	0	1	1
Iowa	11	6	6	11	4	5	49	161	34	0	1	1
Missouri	14	29	29	18	59	215	5	4	16	0	1	1
North Dakota	0	0	0	42	11	7	1	249	27	0	0	0
South Dakota	5	10	1	13	------	------	6	447	26	0	0	0
Nebraska	4	3	4	------	------	------	8	43	43	1	0	0
Kansas	11	7	12	99	9	32	141	12	18	0	0	1
SO. ATL.												
Delaware	0	2	2	------	------	2	1	------	2	0	1	0
Maryland [2]	5	6	10	37	5	24	1	470	139	0	0	8
Dist. of Col.	8	10	10	10	2	2	0	11	9	1	0	1
Virginia	25	51	32	869	420	------	25	168	168	2	3	3
West Virginia	19	14	15	37	13	72	8	54	51	0	1	4
North Carolina [3]	41	33	30	211	7	26	67	434	434	2	2	3
South Carolina [3]	7	10	5	3,948	495	652	3	7	7	1	1	1
Georgia [3]	13	16	10	2,192	136	136	26	72	0	0	0	1
Florida [3]	5	12	9	28	1	11	11	45	31	0	0	2
E. SO. CEN.												
Kentucky	19	18	18	21	65	79	5	7	84	2	2	6
Tennessee	6	12	19	184	64	252	74	67	42	4	3	5
Alabama [3]	15	6	20	1,360	191	352	50	126	126	2	5	5
Mississippi [2]	9	8	8	------	------	------	------	------	------	0	1	1
W. SO. CEN.												
Arkansas	18	11	16	638	203	182	4	21	21	0	0	0
Louisiana [3]	13	22	22	32	36	36	2	61	56	0	2	1
Oklahoma	17	14	15	263	149	149	9	59	15	0	0	2
Texas [3]	57	48	68	895	716	619	307	216	84	0	2	3
MOUNTAIN												
Montana	1	1	1	17	26	26	11	412	9	1	0	1
Idaho	1	1	2	3	2	4	48	46	46	0	0	0
Wyoming	1	1	1	24	------	------	9	8	4	0	0	0
Colorado	14	18	12	80	21	------	43	28	28	1	1	1
New Mexico	1	2	4	6	1	9	5	29	35	0	0	1
Arizona	2	8	6	242	117	95	10	3	3	0	0	0
Utah [2]	0	0	0	458	1	------	149	27	27	0	1	1

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 13, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939	
PACIFIC												
Washington	7	1	1	------	4	3	999	141	58	1	0	0
Oregon	7	1	2	274	39	39	141	27	27	0	0	0
California	18	41	33	223	41	86	326	2,262	144	1	1	3
Total	543	652	707	12,516	3,018	3,018	4,568	9,857	9,857	33	43	106
2 weeks	1,031	1,291	1,401	22,146	6,273	6,273	7,451	16,527	16,527	58	103	201

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939	
NEW ENG.												
Maine	0	0	0	26	10	16	0	0	0	0	0	1
New Hampshire	0	0	0	0	8	8	0	0	0	0	0	0
Vermont	0	0	0	5	6	8	0	0	0	0	0	0
Massachusetts	0	0	0	128	191	260	0	0	0	0	3	2
Rhode Island	0	0	0	4	3	26	0	0	0	0	0	0
Connecticut	0	0	0	72	73	77	0	0	0	0	1	1
MID. ATL.												
New York	1	0	0	419	481	627	0	0	0	9	8	8
New Jersey	1	0	0	224	181	158	0	0	0	2	4	4
Pennsylvania	0	0	1	308	352	590	0	0	0	1	16	13
E. NO. CEN.												
Ohio	1	1	2	354	500	500	1	60	9	4	5	4
Indiana	0	0	0	150	282	174	4	97	5	1	1	1
Illinois	0	1	0	433	548	707	0	10	14	4	1	5
Michigan [2]	1	0	0	321	512	500	1	2	1	2	2	3
Wisconsin	1	1	1	133	304	304	6	6	9	0	0	0
W. NO. CEN.												
Minnesota	1	0	0	124	136	147	13	43	18	1	2	1
Iowa	2	0	0	91	107	156	31	13	13	0	0	0
Missouri	0	0	0	82	148	193	1	19	19	0	6	6
North Dakota	0	0	0	20	21	39	1	2	12	0	0	0
South Dakota	0	1	0	22	22	26	1	5	14	1	1	0
Nebraska	0	0	0	39	30	67	0	7	7	1	1	1
Kansas	0	1	0	135	160	160	1	36	20	0	1	2
SO. ATL.												
Delaware	0	0	0	17	0	13	0	0	0	0	0	0
Maryland [2]	1	0	0	66	66	96	0	0	0	3	0	2
Dist. of Col.	0	0	0	13	12	24	0	0	0	0	0	1
Virginia	2	0	0	54	59	59	1	0	0	2	1	2
West Virginia	1	0	0	66	90	87	0	0	0	3	13	2
North Carolina [3]	3	1	1	84	63	63	0	0	0	3	1	4
South Carolina [3]	0	0	0	17	12	9	0	0	0	3	1	1
Georgia [3]	0	0	0	27	29	20	0	8	0	4	2	2
Florida [3]	0	1	1	11	8	8	0	1	0	0	2	1
E. SO. CEN.												
Kentucky	2	0	0	70	123	86	0	3	2	0	7	7
Tennessee	0	0	0	67	48	48	0	1	1	0	2	4
Alabama [3]	1	1	0	41	24	24	0	0	0	1	5	2
Mississippi [3]	0	1	0	13	9	10	0	0	0	1	3	2

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 13, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939		Jan. 13, 1940	Jan. 14, 1939	
W. SO. CEN.												
Arkansas	2	0	0	9	18	18	3	9	4	4	2	2
Louisiana [3]	0	0	1	19	15	18	0	1	1	7	8	8
Oklahoma	0	0	0	35	47	47	5	11	2	2	4	4
Texas [3]	4	2	1	61	111	111	2	22	12	12	4	14
MOUNTAIN												
Montana	0	0	0	52	24	56	0	2	9	0	2	1
Idaho	1	0	0	12	9	19	0	14	14	0	0	1
Wyoming	0	0	0	5	8	10	0	2	2	1	0	0
Colorado	0	0	0	27	50	61	33	27	7	1	2	0
New Mexico	0	0	0	14	14	24	1	0	0	0	5	5
Arizona	0	0	0	7	7	11	1	15	0	2	1	0
Utah [2]	1	0	0	24	33	33	1	1	0	0	0	0
PACIFIC												
Washington	0	1	1	49	61	56	0	8	31	1	0	2
Oregon	0	1	1	23	66	66	3	14	12	1	3	3
California	16	3	3	161	206	247	0	17	12	1	2	4
Total	42	16	22	4,134	5,287	6,270	110	456	315	78	122	130
2 weeks	85	32	43	7,731	9,746	11,437	184	747	591	159	220	253

Division and State	Whooping cough, week ended Jan. 13, 1940	Whooping cough, week ended Jan. 14, 1939
NEW ENG.		
Maine	65	42
New Hampshire	21	1
Vermont	40	93
Massachusetts	152	227
Rhode Island	16	86
Connecticut	87	113
MID. ATL.		
New York	487	755
New Jersey	115	518
Pennsylvania	414	461
E. NO. CEN.		
Ohio	149	260
Indiana	43	25
Illinois	119	467
Michigan [2]	101	220
Wisconsin	101	318
W. NO. CEN.		
Minnesota	72	38
Iowa	9	12
Missouri	3	20
North Dakota	13	3
South Dakota	4	1
Nebraska	1	5
Kansas	36	9
SO. ATL.		
Delaware	3	6
Maryland [1]	80	41
Dist. of Col.	5	28
Virginia	29	53
West Virginia	11	36
SO. ATL.—continued		
North Carolina [3]	39	284
South Carolina [3]	10	73
Georgia [3]	14	14
Florida [3]	7	14
E. SO. CEN.		
Kentucky	0	9
Tennessee	17	21
Alabama [3]	13	28
Mississippi [2]	------	------
W. SO. CEN.		
Arkansas	3	9
Louisiana [3]	2	1
Oklahoma	0	1
Texas [3]	94	96
MOUNTAIN		
Montana	3	26
Idaho	6	2
Wyoming	6	6
Colorado	15	44
New Mexico	14	21
Arizona	37	6
Utah [2]	79	12
PACIFIC		
Washington	49	24
Oregon	27	24
California	183	103
Total	2,794	4,659
2 weeks	4,871	8,354

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Jan. 13, 1940, 39 cases as follows: North Carolina, 1; South Carolina, 6; Georgia, 13; Florida, 4; Alabama, 7; Louisiana, 2; Texas, 6.

WEEKLY REPORTS FROM CITIES

City reports for week ended Dec. 30, 1939

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	194	619	105	1,354	911	1,524	28	359	23	1,064	--------
Current week [1]	120	434	49	483	494	925	0	321	16	519	--------
Maine:											
Portland	0	------	0	5	3	2	0	0	0	6	25
New Hampshire:											
Concord	0	------	0	0	0	0	0	2	0	0	9
Manchester	0	------	0	0	1	1	0	1	0	0	18
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	10	9
Rutland	0	------	0	0	0	0	0	0	0	0	4
Massachusetts:											
Boston	1	------	1	33	15	32	0	5	1	14	216
Fall River	0	------	0	0	1	1	0	1	0	10	38
Springfield	0	------	0	0	0	2	0	0	1	4	45
Worcester	0	------	0	0	6	7	0	3	0	1	50
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	26
Providence	1	------	0	100	4	4	0	2	0	6	65
Connecticut:											
Bridgeport	0	------	0	0	2	6	0	3	0	0	40
Hartford	0	------	0	0	2	3	0	1	0	3	54
New Haven	0	------	0	0	2	5	0	0	0	5	72
New York:											
Buffalo	0	------	0	2	7	8	0	4	0	7	119
New York	28	9	2	24	61	167	0	07	1	60	1,471
Rochester	0	2	0	0	4	1	0	2	0	3	69
Syracuse	0	------	0	0	2	4	0	0	0	13	49
New Jersey:											
Camden	0	1	1	0	1	5	0	0	0	0	37
Newark	0	1	0	2	7	15	0	9	1	11	104
Trenton	0	------	0	0	1	2	0	0	0	0	41
Pennsylvania.											
Philadelphia	6	5	2	5	27	60	0	22	1	69	498
Pittsburgh	8	2	3	1	14	33	0	9	0	5	150
Reading	2	------	0	0	2	0	0	0	0	5	32
Scranton	0	------	------	0	------	5	0	------	0	0	------
Ohio:											
Cincinnati	2	------	1	0	3	23	0	4	0	6	127
Cleveland	1	127	0	1	15	40	0	15	1	25	215
Columbus	4	2	2	0	3	3	0	0	0	1	90
Toledo	0	1	0	4	5	8	0	2	0	4	72
Indiana:											
Anderson	0	------	0	0	1	0	0	0	0	0	4
Fort Wayne	1	------	1	0	2	4	0	0	0	0	28
Indianapolis	4	------	2	3	11	17	0	6	0	3	117
Muncie	0	------	0	1	2	0	0	0	0	0	14
South Bend	0	------	0	1	1	3	0	0	0	2	16
Terre Haute	1	------	2	0	2	0	0	0	0	0	29
Illinois:											
Alton	0	------	0	0	0	2	0	0	0	0	7
Chicago	9	6	3	8	39	176	0	34	2	41	737
Elgin	0	------	0	0	1	1	0	0	0	3	14
Moline	0	1	0	0	0	1	0	0	0	0	7
Springfield	0	------	0	0	5	0	0	0	0	0	24
Michigan:											
Detroit	2	1	2	3	26	49	0	15	2	18	290
Flint	0	------	0	0	0	21	0	6	0	0	38
Grand Rapids	0	------	1	1	2	20	0	0	0	0	43
Wisconsin:											
Kenosha	0	------	0	1	0	0	0	0	0	5	5
Madison	0	------	0	0	1	1	0	0	0	3	9
Milwaukee	0	------	0	0	5	24	0	3	0	5	106
Racine	0	------	0	0	0	1	0	0	0	5	12
Superior	0	------	0	2	2	2	0	0	0	0	13
Minnesota:											
Duluth	0	------	0	60	5	4	0	1	0	0	37
Minneapolis	1	------	0	2	6	20	0	0	0	3	121
St. Paul	0	------	0	1	4	12	0	1	0	18	59

[1] Figures for Barre, Vt., estimated; report not received.

City reports for week ended Dec. 30, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Iowa:											
Cedar Rapids	0	------	------	6	------	0	0	------	0	1	------
Davenport	0	------	------	0	------	2	0	------	0	0	------
Des Moines	0	------	0	16	0	12	2	0	0	0	42
Sioux City	0	------	------	0	------	4	0	------	0	0	------
Missouri:											
Kansas City	3	------	0	1	6	7	0	7	0	1	97
St. Joseph	0	------	0	0	2	0	0	1	0	0	25
St. Louis	2	------	2	2	10	17	0	5	1	11	240
North Dakota:											
Fargo	0	------	0	0	1	0	0	0	0	0	18
Grand Forks	0	------	------	0	------	0	0	------	0	0	------
Minot	0	------	0	0	0	0	0	0	0	1	6
South Dakota:											
Aberdeen	0	------	------	0	------	2	0	------	0	0	------
Nebraska:											
Lincoln	1	------	------	2	------	1	0	------	0	0	------
Omaha	0	------	0	1	2	2	0	0	0	1	50
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	3
Topeka	0	------	0	1	0	5	0	0	0	0	11
Wichita	1	2	0	37	4	0	0	0	0	1	37
Delaware:											
Wilmington	0	------	0	0	4	0	0	1	0	3	29
Maryland:											
Baltimore	8	9	0	2	19	15	0	11	0	40	213
Cumberland	0	------	0	0	2	2	0	0	0	0	14
Frederick	0	------	0	0	0	0	0	0	0	0	2
Dist. of Col.:											
Washington	3	5	3	0	8	9	0	9	1	10	190
Virginia:											
Lynchburg	1	------	0	0	2	0	0	0	0	1	8
Norfolk	0	------	0	0	4	0	0	3	0	1	28
Richmond	0	------	1	5	6	0	0	1	1	0	65
Roanoke	0	------	0	0	1	2	0	0	0	6	21
West Virginia:											
Charleston	0	1	0	0	1	0	0	0	0	0	9
Huntington	1	------	------	0	------	0	0	------	0	0	------
Wheeling	0	------	0	1	1	6	0	0	0	0	34
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	1	------	0	0	0	1	0	0	0	1	15
Wilmington	0	------	0	0	2	0	0	0	0	0	28
Winston-Salem	0	------	0	0	4	1	0	2	0	0	26
South Carolina:											
Charleston	0	153	0	0	2	1	0	0	0	0	33
Florence	4	27	0	1	1	1	0	1	1	0	23
Greenville	0	------	0	0	4	0	0	0	0	0	14
Georgia:											
Atlanta	5	43	0	3	6	8	0	6	0	0	94
Brunswick	0	------	0	1	2	1	0	0	0	0	4
Savannah	0	45	2	0	7	2	0	3	0	0	52
Florida:											
Miami	0	3	0	1	2	0	0	0	0	2	39
Tampa	0	------	0	0	4	1	0	2	0	0	35
Kentucky:											
Ashland	0	------	0	0	2	1	0	0	0	1	6
Covington	0	1	0	0	5	1	0	3	0	0	21
Lexington	0	------	0	0	2	2	0	2	0	0	16
Louisville	0	1	0	0	7	14	0	3	0	28	96
Tennessee:											
Knoxville	0	------	2	2	3	10	0	0	1	0	36
Memphis	1	------	0	2	1	4	0	4	2	1	68
Nashville	3	------	0	1	6	2	0	1	0	0	63
Alabama:											
Birmingham	1	24	4	0	3	3	0	3	0	0	77
Mobile	0	2	0	0	3	1	0	0	0	1	22
Montgomery	0	11	------	2	------	1	0	------	0	0	------
Arkansas:											
Fort Smith	1	------	------	0	------	3	0	------	1	0	------
Little Rock	1	------	0	0	3	1	0	0	0	0	8
Louisiana:											
Lake Charles	0	------	0	0	0	0	0	0	0	0	5
New Orleans	5	6	5	0	16	10	0	9	0	10	174
Shreveport	2	------	1	0	8	0	0	2	0	0	43
Oklahoma:											
Oklahoma City	0	------	0	0	2	2	0	0	0	0	82
Tulsa	2	------	------	0	------	0	0	------	0	0	------

City reports for week ended Dec. 30, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Texas:											
Dallas	3	------	1	0	4	5	0	1	0	2	66
Fort Worth	0	------	0	0	8	0	0	1	0	0	39
Galveston	0	------	0	0	2	0	0	0	0	0	13
Houston	0	1	2	0	7	3	0	2	0	0	71
San Antonio	0	5	0	34	9	0	0	5	0	3	67
Montana:											
Billings	0	------	1	0	0	0	0	0	0	0	9
Great Falls	0	------	0	1	1	0	0	0	0	0	14
Helena	1	------	0	0	0	0	0	0	0	0	2
Missoula	0	------	0	8	1	0	0	0	0	4	6
Idaho:											
Boise	0	------	0	0	1	0	0	0	0	0	5
Colorado:											
Colorado Spgs	0	------	0	0	0	0	0	1	0	1	13
Denver	6	------	1	4	10	7	0	4	1	3	81
Pueblo	0	------	0	0	0	2	0	0	0	0	10
New Mexico:											
Albuquerque	0	------	0	1	1	1	0	1	0	0	10
Utah:											
Salt Lake City	0	------	2	28	2	1	0	1	0	31	35
Washington:											
Seattle	2	------	0	27	6	4	0	2	0	6	112
Spokane	0	1	1	4	1	3	0	1	0	1	33
Tacoma	0	------	0	60	0	0	0	0	0	0	29
Oregon:											
Portland	4	2	1	5	3	1	0	2	0	6	77
Salem	0	------	------	0	------	0	0	------	0	0	------
California:											
Los Angeles	4	10	0	6	14	15	0	14	0	17	356
Sacramento	0	------	0	0	5	0	0	1	0	0	36
San Francisco	2	1	2	4	3	8	0	8	0	11	169

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Maine:				Michigan:			
Portland	0	1	0	Detroit	1	0	0
Massachusetts:				Iowa:			
Boston	0	0	1	Des Moines	0	0	1
Rhode Island:				Alabama:			
Providence	1	0	0	Mobile	1	0	0
New York:				Louisiana:			
New York	1	0	0	Shreveport	0	1	0
Pennsylvania:				Texas:			
Philadelphia	0	0	1	Houston	0	0	1
Pittsburgh	2	0	0	Washington:			
Illinois:				Spokane	1	0	0
Chicago	4	0	1				

Encephalitis, epidemic or lethargic.—Cases: Portland, Maine, 1; New York, 3; Sioux City, 1.
Pellagra.—Cases: Charleston, S. C., 2; Atlanta, 1; Savannah, 1.
Typhus fever.—Cases: Charleston, S. C., 1; Savannah, 1; Miami, 1; Nashville, 1; Mobile, 1; New Orleans, 2.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 9, 1939.—During the week ended December 9, 1939, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1		3	1					5
Chickenpox		9	12	242	501	67	63	65	69	1,028
Diphtheria		1		35	3	10	3			52
Influenza		64			45	1			25	135
Measles		1		80	279	70	1	17	28	476
Mumps		1		27	139	11	24	3	18	223
Pneumonia	1	14			14	1			7	37
Poliomyelitis				2	2	1				5
Scarlet fever	4	10	19	146	174	23	9	31	19	435
Smallpox									4	4
Trachoma									1	1
Tuberculosis		7		46	36	7	22	4		122
Typhoid and paratyphoid fever		1		13	3	1	1	1		20
Whooping cough	1	24		67	87	39	46	21	15	300

JAMAICA

Communicable diseases—4 weeks ended December 23, 1939.—During the 4 weeks ended December 23, 1939, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	2	19	Leprosy		1
Diphtheria	1	5	Puerperal fever		2
Dysentery	6	5	Tuberculosis	21	72
Erysipelas	1	2	Typhoid fever	7	62

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases for a six-month period appeared in the PUBLIC HEALTH REPORTS of December 29, 1939, pages 2319–2333. A cumulative table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Bolivia—Chuquisaca Department—Chuquisaca.—During the period August 1 to September 30, 1939, 1 case of pneumonic plague was reported in Chuquisaca, Chuquisaca Department, Bolivia.

Brazil.—During the months of April and May 1939, plague was reported in Brazil as follows: Alagoas State, 8 cases, 3 deaths; Pernambuco State, 9 cases, 4 deaths; Sao Paulo State, 1 case.

Thailand—Kamphaeng Bajı Pıovince.—During the week ended December 30, 1939, 6 cases of plague were reported in Kamphaeng Bajr Province, Thailand.

Typhus Fever

Cuba—Pinaı del Rio Province.—According to a report dated December 13, 1939, 1 case of typhus fever was reported in Pinar del Rio Province, Cuba.

Yellow Fever

Brazil—Espirito Santo State—Guarapari —On December 14, 1939, 1 death from the jungle type of yellow fever was reported in Guarapari, Espirito Santo State, Brazil.

Ivoıy Coast—Sankadiokro.—On December 31, 1939, 1 fatal case of yellow fever was reported in Sankadiokro, Ivory Coast.

Public Health Reports

VOLUME 55 JANUARY 26, 1940 NUMBER 4

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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THE DISABLING DISEASES OF CHILDHOOD*

Their Characteristics and Medical Care as Observed in 500,000 Children in 83 Cities Canvassed in the National Health Survey, 1935–1936

I. CHARACTERISTICS AND LEADING CAUSES

By DOROTHY F. HOLLAND, *Statistician, United States Public Health Service*

The decline in the death rate which has occurred in the present century is largely the result of the reduction in the mortality of childhood. The diseases which have been brought under most successful control are infectious in nature, and the benefits of this advance have accrued mainly to the period of childhood in which these diseases are most frequent. While notable progress has been made in reducing childhood mortality, children continue to experience a high frequency of illness, of which the preventable diseases remain a major cause. These facts are familiar to the private practitioner and the medical and nursing personnel of official and nonofficial health agencies. It is believed, however, that a review of the characteristics of illness in childhood may be of use in redefining the objectives of professional and lay workers in the field of child health.

The disabling illnesses occurring in a 12-month period in over 500,000 children canvassed in the National Health Survey present the basic data required for such a broad analysis. The records relate to illness as it is recognized by the layman and enumerated in a house-to-house canvass. This method was first used in a representative general population by the Committee on the Costs of Medical Care in 1928–31 (*1*). The National Health Survey, made in 1935–36, represents its most recent and extensive application.

The second report in this series on disabling illnesses in childhood will consider the medical and nursing care of the diseases of children as observed in the survey. The present report thus serves the further purpose of providing a basis for the interpretation of the results relating to medical services received by the surveyed group.

* From the Division of Public Health Methods, Section on Medical Care Studies, National Institute of Health.

METHOD OF THE SURVEY

The records of illness which form the basis of the present report represent a 12-month experience of over half a million children in almost three-quarters of a million families canvassed by the United States Public Health Service in the winter of 1935–36. The canvass was Nation-wide in respect to its coverage of urban communities, which included 83 cities in 18 States,[1] but the scope of the survey permitted only a limited sampling of rural areas in 3 States.

The surveyed cities were selected in such a manner as to give adequate representation to each geographic area, but financial considerations made it impossible to include the number of cities required to give an urban sample having the same composition by city-size as the total urban population of the country.[2] Internal representativeness of the surveyed population was obtained by making a complete canvass of 51 cities of less than 100,000 population, and sampling [3] the households of 31 cities of 100,000 population and over, and 1 city of the former population class.[4]

The information concerning the social and economic characteristics of the family and its illness record in a 12-month period was obtained by the enumerator from a lay informant, usually the housewife.[5] "Illness"[6] was defined as a disease, injury, or permanent gross impairment, congenital or acquired, which had caused disability for at least 7 consecutive days in a 12-month period falling approximately in the year 1935. An exception to this definition was made in the enumeration of chronic diseases and gross permanent impairments

[1] A list of the surveyed cities is given in Appendix B of "The National Health Survey: Scope and Method of the Nation-Wide Family Canvass of Sickness in Relation to its Social and Economic Setting," by George St. J. Perrott, Clark Tibbitts, and Rollo H. Britten. Public Health Reports, 54: 1663 (1939).

[2] The distribution of the surveyed population by geographic area agrees closely with that of the total urban population as enumerated in the Federal Census of 1930. The distribution by population class of the city of residence is necessarily somewhat less representative, 74 percent of the surveyed population being drawn from cities of 100,000 and over as compared with 52 percent for the total urban population in 1930. For the cities of 25,000 to 100,000 population the corresponding figures were: Health Survey, 14 percent; Census of 1930, 19 percent; and for cities of less than 25,000 population: Health Survey, 12 percent; Census of 1930, 29 percent.

[3] The sampling procedure consisted of a random selection of districts to be canvassed within each city, the districts used being those outlined for the enumeration of the population in the Federal Census of 1930. Districts containing approximately equivalent units of population were obtained by arbitrary division of the Census enumeration districts having a population in excess of 1,000. The number of such districts to be surveyed was determined by the number of surveyed families required to give a sample adequately representing the given city and sufficient to produce an urban sample representative of all regions of the country and, within the limitations of the survey, balanced in respect to size of the cities included. A complete canvass was made of the districts selected in this manner. For a complete description of the sampling procedure, see the publication referred to in footnote 1.

[4] The proportion of surveyed children under 10 years of age was somewhat lower than in the total population of the surveyed cities as enumerated in the Federal Census of 1930. The comparative figures (i. e., children under 10 years as a percentage of children under 15 years) are as follows: Cities of 100,000 population and over, Health Survey, 62.4, Census, of 1930, 65.8; cities of 25,000 to 100,000 population, Health Survey, 63.1, Census of 1930, 67.5; cities under 25,000 population, Health Survey, 63.0, Census of 1930, 65.5.

[5] A reproduction of the survey schedule is included in the publication referred to in footnote 1.

[6] Certain exceptions to this definition were made. Records of all confinements, hospital cases, and deaths were taken without limitation as to the duration of disability.

which were recorded without limitation as to the existence or duration of disability.

With the exception of the data on orthopedic impairments, the illnesses of childhood considered in this report are restricted to those disabling for a minimum of 7 consecutive days. In the period of childhood, disability was used in the sense of interference with normal activity, i. e., play of the preschool child or school attendance of older children. The latter criterion of disability is objective, but the lack of similarly definitive measures of disability among infants and very young children may lead to an understatement of the frequency and duration of disabling illness in the early years of childhood.

Confirmation of the informant's statement of the cause of illness was requested from the attending physician for cases so attended, but the majority of the medical causes of illness are those assigned by the lay informant. The diagnoses of illnesses having multiple causes were listed by the enumerator in order of their importance as causes of incapacity. In the subsequent coding of these records, the primary, as distinguished from the contributory, cause of illness was taken as the diagnosis which had caused the longest period of disability. An illness due to multiple causes was considered as a single illness, but data concerning the several causes were coded separately so that all cases of a given disease could be segregated, whether designated as the sole, primary, or contributory cause of the illness.

The present report relates principally to a 12-month illness experience of 518,767 white children under 15 years of age living in 83 surveyed urban communities.[7] Included in this total are 373,446 children of these ages in 31 surveyed cities of 100,000 population and over, 78,426 children in 10 cities of 25,000 to 100,000 population, and 66,895 children in 42 cities under 25,000 population. The results of the survey of children in rural areas, and of canvassed Negro children are considered only incidentally.

CHARACTERISTICS OF DISABLING ILLNESS IN A 12-MONTH PERIOD

Frequency.—Among white urban children, the period included in the first 10 years of life, exclusive of infancy, is characterized by a high frequency of illness which is not again approximated until the period of old age. This fact, first established by Sydenstricker's studies of illness in Hagerstown, Md. (*2*), was confirmed by the results of the canvass of representative white families made by the Committee on the Costs of Medical Care (*1, 3*). The results of the National Health Survey show general agreement with these earlier studies.

Among children 5 to 9 years of age, the frequency rate of disabling illness was 305 per 1,000. This rate was higher than that in any age

[7] The majority of tabulations of data which form the basis of the present report exclude 14,194 white children under 15 years of age in families whose annual income was reported as "unknown."

period observed, exceeding even the rate for persons over 65 years of age. Next in order of magnitude was the rate for children of preschool age (1 to 4 years), 251 per 1,000. In the age period 10 to 14 years, the rate was 153 per 1,000, representing a notably lower incidence than in the preceding quinquennium.[8] The experience of a sample of the surveyed child population forms the basis for these rates (see Appendix table 1).

The nature of the age variation in the frequency rate of disabling illness may be observed in figure 1. The rates plotted are based on the experience of 280,073 white persons in 8 large cities included in the survey. Appendix table 1 presents the frequency rates by age in the surveyed white population of these 8 cities, and in a sample of the entire surveyed white population of 83 cities. It will be noted that the absolute magnitude of the frequency rates in the two surveyed groups shows consistent differences, but the relative variation of the rates by age is of the same nature. The rates for the 8 cities are plotted since other data shown in figure 1 relate to this surveyed group.

The method of the present survey imposes certain limitations on the definition of the characteristics of disabling illness among infants under 1 year of age. The disabling illnesses recorded in the survey were those occurring in the 12 months prior to the date of the canvass. Infants under 1 year of age, as of the survey date, were the survivors of births occurring in the preceding 12 months, and were, therefore, exposed to the risk of illness for periods varying from less than a month to 12 months. In this respect, the illness experience of infants under 1 year of age differs from that of the population at ages 1 year and over, which, with the exception of persons dying in the survey year, was exposed to the risk of illness for 12 months. The conversion of the various measures of illness among infants under 1 year of age to a 12-month basis involves certain assumptions concerning the incidence rate of illness at specific months of age in the first year which cannot be verified on the basis of existing morbidity data. Future analysis of the results of the National Health Survey may contribute information on this point. The present report adopts the practice of expressing the *observed* rate of illness among infants under

[8] The frequency rate of disabling illness among children in certain canvassed rural areas showed departures from the pattern of age variation observed in the urban group. Among rural farm children canvassed in Missouri, the highest rate was observed not at the ages 5 to 9 years, but in the following quinquennium; in Michigan, the rate for rural farm children 10 to 14 years old was lower than that for ages 5 to 9, but represented 86 percent of the rate for children under 15, compared with 66 percent for rural nonfarm children in this State. The results are consistent with previous studies (*4, 5*) of the age incidence of certain acute communicable diseases which indicate a later age of attack in rural areas. A future report in this series will consider the results of the survey of children in rural areas.

On the other hand, a preliminary report has indicated that the highest disabling illness rate among Negro children occurs in the ages under 5 (*6*). This difference, in comparison with the experience of white children, is accounted for in part by the characteristic differences exhibited by the two groups in the incidence of the common communicable diseases of childhood.

1 year of age per 1,000 live births. Such a rate permits certain internal comparisons within the period of infancy, but its absolute magnitude in relation to the rates observed at subsequent ages is without significance.[9]

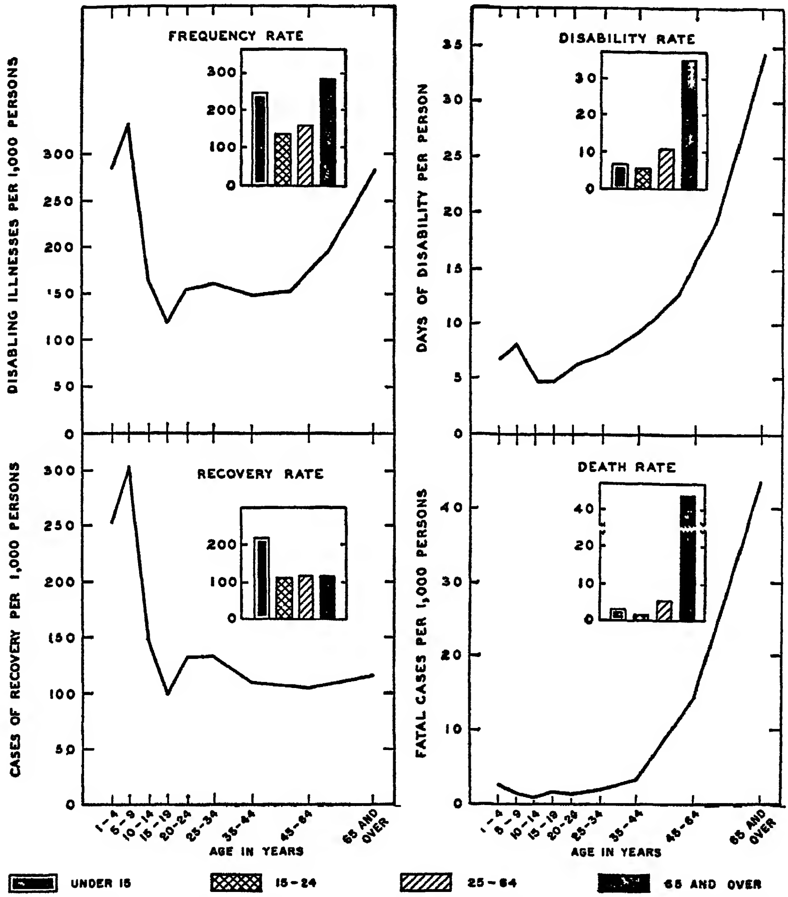

FIGURE 1.—Frequency, disability, and recovery rates of illness disabling for 7 consecutive days or longer, and the observed death rate based on all fatal cases in a 12-month period, by age—280,073 white persons in 8 large cities canvassed in 1935–36. The rates for infants under 1 year of age are not shown since the period of exposure was less than 12 months.

Severity.—The effect of the high frequency of illness on child health is ameliorated by the low mean duration and high recovery rate which characterize childhood illness except in the period of infancy.

---

[9] The only published data available on the incidence of illness among infants in a representative population are those obtained in the survey of the Committee on the Costs of Medical Care, reported by Falk, Klem, and Sinai (*1*). These authors show the incidence rate of illness, disabling and nondisabling, among (1) infants born during the survey year, and (2) infants under 1 year of age at the beginning of the 12-month period of observation. The exposure of the second group comprises part of the first and second years of life.

The severity rate, i. e., the mean duration of illness, was found to be lowest in childhood (Appendix table 1). As a result, the amount of disability accruing from the illnesses of childhood was disproportionately low with reference to the high frequency of illness at this period. This may be observed by a comparison of the frequency and disability rates plotted in figure 1.

At specific ages of childhood, the relative variation in the disability and frequency rates was similar, the maximum point in both rates in the period of childhood occurring at ages 5 to 9. Children 5 to 9 years of age (including both sick and well) experienced 8 days of disability per capita in the 12-month period from illness involving a minimum of 7 consecutive days of disability. Next in order was the rate for children of preschool age, 7 days per capita. In the age period 10 to 14 years, the rate was 5 days per capita. This rate is high in consideration of the low frequency of illness in this age period; it results from a mean duration of illness which exceeds that of children between 1 and 10 years of age. The disability rates at specific ages of childhood which are given here (shown in Appendix table 1 and figure 1) are based on the experience of 65,136 white children in 8 large cities included in the survey; these data are not yet available for the entire surveyed population.

The severity of illness may be evaluated also by a consideration of the probability of its termination in recovery or death. The recovery rate in childhood, exclusive of the first year, was found to be high compared with the rate in the adult period; and the death rate, i. e., the incidence of fatally terminating illnesses, is low compared with that of adults over 25 years of age. Within the period of childhood, it is notable that the recovery rate was lower and the death rate higher among children 1 to 4 years of age than in the age period 5 to 9 years. The nature of the age variation in these rates may be observed in Appendix table 1 and in the two lower graphs of figure 1; the rates are based on the experience of surveyed persons in 8 large cities. Appendix table 1 includes also the frequency rates of incompleted cases which had caused disability for a minimum of 7 days. It will be noted that in childhood, illnesses which were not terminated at the date of the survey formed a lower proportion of all disabling illnesses than in the period of adult life.

The death rates observed in the survey are lower than rates based on registered deaths; this deficiency results from the method employed, the house-to-house canvass, which does not obtain complete reporting of deaths. Previous surveys conducted by this method have shown a similar discrepancy. However, a correction for unreported deaths would not alter significantly the relative magnitude of the recovery and death rates.

Mortality rates are generally recognized as an incomplete measure of the importance of a given health problem. The implications of this fact are of particular significance in childhood, in which, after the first year of life, the probability of recovery from illness greatly exceeds the probability of death.

THE DISABLING DISEASES OF CHILDREN

Diseases classified in major groups.—Eight out of 10 disabling illnesses among children under 15 years of age observed in this survey were due to the acute communicable diseases of childhood or the acute diseases of the respiratory system, including influenza, tonsillitis, colds, pneumonia, and bronchitis. Among these 8 cases, about 5 were acute communicable diseases of childhood, and 3 were cases of acute respiratory disease.

The figures shown in table 1 indicate that the frequency rate of disabling illness due to the communicable diseases in children under 15 years of age was about 12 times as high as the rate for the group of major chronic diseases and orthopedic impairments, 14 times as high as the rate for acute diseases of the digestive system, and almost 10 times as high as the rate for injuries due to accident. The communicable diseases are, furthermore, characteristically childhood diseases; their frequency declines sharply after the peak in childhood, and becomes almost negligible among adults. On the other hand, while the frequency of illness due to diseases of the respiratory system is likewise higher in childhood than in the adult period, the incidence of these diseases among adults is maintained at a relatively high level. The nature of the age variation in the frequency of disabling illness due to these two groups of diseases may be observed in figure 2 (page 148).[10]

---

[10] For the purpose of a broad classification of the causes of disabling illness in childhood, four groups of diseases having certain common characteristics have been used. By excluding influenza, tuberculosis, and specific infections of the intestinal tract from the specific infectious diseases, a new *communicable* group has been established which comprises mainly the common communicable diseases of childhood—measles, mumps, chickenpox, whooping cough, scarlet fever, and diphtheria. Influenza has been combined with the diseases of the nose, throat, and lungs (except respiratory tuberculosis) to form the *respiratory* group which, in childhood, includes largely acute diseases—tonsillitis, colds, pneumonia, and bronchitis, in addition to influenza. The specific infectious diseases of the intestinal tract have been combined with other diseases of the digestive system to form the *digestive* group, which includes appendicitis, indigestion, biliousness, diarrhea and enteritis, ulcer of the stomach or duodenum, and diseases of the gall bladder or liver. Finally, tuberculosis, all forms; nervous and mental disease or defect; cancer; rheumatism; diabetes; cerebral hemorrhage and other forms of paralysis; diseases of the heart, arteriosclerosis and high blood pressure, and other diseases of the circulatory system, exclusive of hemorrhoids and varicose veins; and nephritis and other nonvenereal diseases of the genitourinary system, exclusive of circumcision and diseases of the female genital organs, have been combined under the group of major chronic diseases. By definition, certain chronic diseases of the respiratory and digestive systems are included, respectively, in the respiratory and digestive groups; however, the incidence of these chronic diseases is relatively low in childhood, and among children under 15 years of age the respiratory and digestive groups of diseases as used here comprise chiefly acute diseases.

TABLE 1.—*Frequency, severity, and disability rates of illness disabling for 7 consecutive days or longer in a 12-month period classified by age and cause in broad groups—sole or primary causes only—2,152,740 white persons [1] in 83 cities canvassed in 1935–36*

Age period (years)	All causes	Communicable diseases [3]	Diseases of the respiratory system [4]	Major chronic diseases and orthopedic impairments: Total	Tuberculosis, all forms	Nervous and mental diseases [5]	Other major chronic diseases [6]	Orthopedic impairments	Diseases of the digestive system [7]	All other diseases	Accidents
	Frequency rate (disabling [8] illnesses per 1,000 persons)										
All ages [2]	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Under 15	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15–24	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
65 and over	275.6	2.3	58.6	134.7	.9	9.9	109.3	14.6	19.6	33.2	27.1
	Disability rate (days of disability per person)										
All ages [2]	9.83	0.70	1.15	4.69	0.32	1.03	2.45	0.89	0.74	1.79	0.75
Under 15	5.93	2.24	1.26	1.12	.09	.43	.32	.28	.23	.72	.36
15–24	5.31	.28	.67	1.96	.34	.81	.44	.38	.53	1.35	.51
25–64	10.26	.19	1.11	5.14	.43	1.28	2.56	.87	.91	2.03	.88
65 and over	35.44	.15	2.54	23.53	.20	1.99	16.26	5.08	1.96	5.28	1.97
	Severity rate (days of disability per disabling [8] illness)										
All ages [2]	57	23	23	158	243	190	123	306	59	54	48
Under 15	26	21	17	124	184	169	66	235	30	41	33
15–24	41	22	18	166	232	206	89	251	39	33	39
25–64	69	38	26	154	256	188	116	305	66	54	51
65 and over	129	65	43	175	221	203	149	347	100	160	73

[1] Exclusive of persons in families for which income was reported as unknown.
[2] Rates for all ages are based on the total cases and total population of known ages only.
[3] Include chiefly the communicable diseases of childhood, measles, mumps, chickenpox, whooping cough, scarlet fever, and diphtheria.
[4] Include influenza, pneumonia, colds, bronchitis, tonsillitis, pleurisy, sinusitis, asthma, hay fever, and other diseases of the respiratory system except respiratory tuberculosis.
[5] Include mental defects.
[6] Include cancer; rheumatism; diabetes; cerebral hemorrhage and other forms of paralysis; diseases of the heart, arteriosclerosis and high blood pressure, and other diseases of the circulatory system, exclusive of hemorrhoids and varicose veins; nephritis and other nonvenereal diseases of the genitourinary system, exclusive of diseases of the female genital organs.
[7] Include appendicitis, indigestion, biliousness, diarrhea and enteritis, ulcer of the stomach or duodenum, diseases of the gall bladder or liver, and other diseases of the digestive system.
[8] Disabling for 7 consecutive days or longer in a 12-month period. All confinements, fatal, and hospital cases are included without reference to the duration of disability.

The communicable and respiratory diseases likewise accounted for over half of the disability rate of children under 15 years of age in the survey year, the communicable diseases disabling each child on the average about 2 days and the acute respiratory diseases about 1 day. The disability rate for the major chronic diseases (exclusive of tuberculosis and nervous and mental disease and defect) was about three-tenths of a day per child; the rate for orthopedic impairments was approximately the same. Nervous and mental disease and defect accounted for a disability rate of about four-tenths of a day per child and tuberculosis for one-tenth of a day; however, these diseases are incompletely reported in the house-to-house canvass, and the actual rates are probably somewhat higher than those observed.

Broadly considered, the groups of acute communicable and respiratory diseases thus include the major diseases of childhood. The individual child suffering from heart disease, tuberculosis, or crippling impairments presents medical and social problems of the first importance; on the average, however, these diseases account for relatively little disability in childhood.

Table 2 shows the frequency rates of disabling illness due to the two major groups of children's diseases, the communicable and respiratory, among children in the surveyed cities classified by size. The incidence of the communicable diseases was notably higher among children in the small cities under 25,000 population than in the intermediate (25,000 to 100,000 population) and large cities (100,000 population and over). The excess is not attributable to epidemics occurring in the small cities of a single region, since it is apparent in the rates of small cities in each geographic area. The difference in the magnitude of the frequency rates of the communicable diseases among children in the small and large cities is not explained by variation in age composition of the child population, since the age distribution of children in the three groups of surveyed cities was found to be essentially the same. Furthermore, the excess in the frequency rates among children in the small cities, compared with the large cities, is of a high order only for the group of communicable diseases.

TABLE 2.—*Frequency rate and frequency index of disabling*[1] *illness in childhood in a 12-month period, by cause in two major groups in surveyed cities classified by geographic area and size—sole or primary causes only—518,767 white children under 15 years of age in 83 cities canvassed in 1935–36*

Area and population class of surveyed city	All causes	Communicable diseases[3]	Diseases of the respiratory system[4]	All other causes
	Frequency rate (disabling illnesses per 1,000 persons under 15 years of age)			
Total urban, all areas[2]	224.6	105.4	74.2	45.0
100,000 and over	211.7	93.4	73.9	44.4
25,000–100,000	220.0	103.8	71.9	44.2
Under 25,000	301.9	173.9	79.1	48.9
	Frequency index (frequency rate, cities of 100,000 population and over=100)			
Northeast:				
25,000–100,000	95	109	76	100
Under 25,000	119	148	98	102
Central:				
25,000–100,000	115	118	112	114
Under 25,000	181	247	105	121
West:				
25,000–100,000	96	111	75	99
Under 25,000	122	148	99	102
South:				
25,000–100,000	120	137	118	97
Under 25,000	112	148	93	94

[1] Disabling for 7 consecutive days or longer in a 12-month period. All fatal and hospital cases are included without reference to the duration of disability.
[2] Exclusive of cases and persons in families with income unknown.
[3] For the diseases included, see footnote 3, table 1.
[4] For the diseases included, see footnote 4, table 1.

When the frequency rates of disabling illness are classified in a similar manner by cause according to the income status of the surveyed children, as shown in table 3, it is found that the excess in the incidence of the communicable diseases in the small cities is marked in each income class. Among children in relief families in the small cities, illness due to the communicable diseases was 82 percent more frequent than among children in these families in cities of 100,000 population and over; among children in families with income in excess of $3,000, the figure was 81 percent, and in the intermediate income classes, the excess ranged from 85 to 96 percent. On the other hand, in no income class was an excess of this order observed in the small-city rates for other causes of illness.

TABLE 3.—*Frequency rate and frequency index of disabling* [1] *illness in childhood in a 12-month period, by income and cause in two major groups, in surveyed cities classified by size—sole or primary causes only—518,767 white children under 15 years of age in 83 cities canvassed in 1935–36*

Population class of city and income	All causes	Communicable diseases [3]	Diseases of the respiratory system [4]	All other causes
	Frequency rate (disabling illnesses per 1,000 persons under 15 years of age)			
Total urban, all incomes [2]	224.6	105.4	74.2	45.0
100,000 and over	211.7	93.4	73.9	44.4
25,000–100,000	220.0	103.8	71.9	44.2
Under 25,000	301.9	173.9	79.1	48.9
	Frequency index (frequency rate under 15 years, cities of 100,000 population and over=100)			
Relief				
25,000–100,000	99	104	93	99
Under 25,000	136	182	101	102
Nonrelief.				
Under $1,000:				
25,000–100,000	102	109	97	99
Under 25,000	141	187	104	109
$1,000–$2,000				
25,000–100,000	108	120	94	101
Under 25,000	152	196	114	116
$2,000–$3,000:				
25,000–100,000	111	111	117	98
Under 25,000	147	185	115	116
$3,000 and over:				
25,000–100,000	113	113	121	95
Under 25,000	146	181	119	119

[1] See footnote 1, table 2.
[2] See footnote 2, table 2.
[3] For the diseases included, see footnote 3, table 1.
[4] For the diseases included, see footnote 4, table 1.

Important specific diseases of children.—In the group of communicable diseases, the most frequently reported disabling illnesses of children under 15 years of age were measles, chickenpox, whooping cough, mumps, and scarlet fever. In general, measles showed the highest incidence and diphtheria the lowest, the relative frequency of the other communicable diseases of childhood showing some variation in the large, intermediate, and small surveyed cities. Among sur-

veyed children under 15 years of age in the large cities, measles occurred at a rate of 37.4 per 1,000, a rate notably higher than that for chickenpox (18.8), whooping cough (13.9), mumps (11.5), and scarlet fever (11.1). In the small surveyed cities, the frequency rate of measles was 67.5 per 1,000, and the rate for mumps, 47.4 per 1,000, was second in order of frequency. Table 4 gives the frequency rates of disabling illness due to certain important diseases of childhood among children under 15 years of age in surveyed cities of three population classes.

TABLE 4.—*Frequency rates of important disabling[1] diseases of childhood in a 12-month period in a sample of 518,767 surveyed white children under 15 years of age in 83 cities classified by size, and rates by specific ages in a sample of 373,446 white children in 31 cities of 100,000 population and over—sole, primary, and contributory causes—1935–36*

Diagnosis	Population class			Cities of 100,000 and over			
				Age period			
	100,000 and over	25,000–100,000	Under 25,000	Under 1	1–4	5–9	10–14
	Frequency rate per 1,000 persons under 15 years			Frequency rate			
				Per 1,000 live births	Per 1,000 persons		
Communicable diseases:							
Measles[2]	37.4	32.8	67.5	3.6	48.4	61.4	14.2
Chickenpox	18.8	15.5	27.2	8.1	27.8	29.9	4.8
Whooping cough	13.9	8.0	21.6	6.3	27.1	20.8	.7
Mumps	11.5	32.5	47.4	.9	8.1	19.0	8.4
Scarlet fever	11.1	9.5	11.7	----------	10.2	17.1	7.9
Diphtheria	1.1	2.0	1.5	----------	1.1	1.7	.8
Acute diseases of the respiratory system:							
Tonsillectomy, adenoidectomy	18.4	15.3	17.8	----------	14.2	27.9	15.1
Influenza, grippe	14.4	25.5	22.8	3.6	11.5	18.2	14.2
Colds	13.6	6.5	12.6	13.5	18.5	16.1	8.4
Tonsillitis	8.2	6.8	9.4	1.8	8.8	10.7	6.5
Pneumonia	7.9	11.0	9.6	13.5	13.8	8.5	2.9
Bronchitis	6.9	3.8	5.8	10.8	9.7	8.2	3.5
Chronic diseases and impairments:							
Diseases of the nervous system	3.0	3.0	2.9	3.6	3.2	2.8	3.0
Diseases of the heart	2.1	1.0	1.8	8.1	.5	2.2	2.2
Rheumatism	1.9	1.8	2.0	----------	.7	2.3	2.5
Nephritis	1.6	2.0	2.3	----------	1.1	2.0	1.8
Orthopedic impairments	1.6	.8	.9	.9	1.8	1.5	1.7
Acute diseases of the digestive system:							
Appendicitis	3.9	4.0	3.8	----------	1.4	3.7	6.2
Indigestion	1.7	2.0	3.2	----------	2.9	1.5	1.2
Diarrhea, enteritis	1.0	1.8	2.3	5.4	2.0	.5	.3
All other diseases:							
Ear, mastoid diseases	8.5	4.8	7.6	8.1	14.5	.9	3.7
Cervical adenitis, other diseases of lymphatic system	2.4	1.5	1.8	----------	4.5	2.6	1.4
Congenital malformations,[3] diseases of early infancy	1.3	1.5	.9	19.9	.2	----------	.3
Circumcision	.7	1.0	1.2	2.7	1.1	.8	.1
Accidents, total[4]	11.2	10.5	14.3	1.9	10.2	11.6	12.8
Home	5.4	(5)	(5)	1.1	7.5	5.9	4.3
Other public	4.8	(5)	(5)	.3	1.2	5.4	7.1
Automobile	1.9	(5)	(5)	.8	1.1	2.2	2.3

[1] See footnote 1, table 2.
[2] Includes German measles.
[3] Except congenital malformation of the heart, which is included with diseases of the heart.
[4] Rates for accidental injuries by place of occurrence are based on the experience of 65,136 white children under 15 years of age in 8 cities of 100,000 population and over. For the cities included, see footnote 3, Appendix table 1. Rates are exclusive of contributory causes.
[5] Data not available.

On the average, measles shows a higher frequency than the other communicable diseases of childhood, but the marked excess observed in this survey reflects an unusually high incidence of this disease in 1935, the approximate survey year (*7*). The relatively high incidence of mumps, especially in the two groups of cities under 100,000 population, is of interest in view of the prevailing opinion (*8*) that this disease is notably less frequent than measles, whooping cough, and chickenpox. Collins (*9*) has also reported a relatively high incidence of mumps among children canvassed in the survey of the Committee on the Costs of Medical Care. The decreasing frequency of diphtheria as a cause of illness in childhood is evident in the relatively low rates observed for this disease in the present survey; among children 1 to 10 years of age, however, diphtheria remains a leading cause of death.[11]

The high incidence of the communicable diseases among children in the small surveyed cities was noted in the preceding section. The rates shown in table 4 indicate that the excess is accounted for principally by the higher frequency of measles and mumps among children in the small cities; the rates for whooping cough and chickenpox show the same tendency in less marked degree. The incidence of measles, based on cases reported by city health officers to the United States Public Health Service, was likewise higher in 1935 in small cities (10,000 to 25,000 population) than in cities of 100,000 population and over. The incidence of chickenpox in that year, based on data from the same source, showed a similar tendency. These rates are shown in the following table; they are based on cases in all reporting cities of the specified population classes located in the States included in the National Health Survey. Data for cities under 10,000 population were not available, and the "small cities," therefore, include those between 10,000 and 25,000 population.

[11] The importance of malaria as a child health problem in certain sections of the country is indicated by the results of the survey of rural children in a Southern State. Among white children under 15 years of age in surveyed rural areas, the disabling illness rates for malaria were 24.7 per 1,000 for the nonfarm area and 16.2 for the farm area, compared with rates between 1.0 and 2.8 per 1,000 for children in 20 Southern cities. The figures are shown in the following table:

Classification of population	Disabling illnesses per 1,000 persons under 15 years of age			
	Communicable diseases *		Malaria	
	White	Negro	White	Negro
Urban (sample):				
100,000 and over	60.7	22.5	1.0	2.0
25,000–100,000	83.2	21.7	1.5	2.6
Under 25,000	89.9	26.5	2.8	13.1
Rural:				
Nonfarm	54.5	62.2	24.7	17.8
Farm	42.0	43.0	16.2	22.1

*Include parasitic diseases. For the definition of this group, as used here, see footnote 10.

Incidence rates of certain communicable diseases in 1935, based on cases of the notifiable diseases reported to the United States Public Health Service[1]

Disease	Rate per 1,000 persons (all ages)							
	East		Central		West		South	
	100,000 and over	10,000–25,000	100,000 and over	10,000–25,000	100,000 and over	10,000–25,000	100,000 and over	10,000–25,000
Measles	5.4	11.3	9.7	18.3	3.7	14.3	1.7	4.0
Scarlet fever	2.1	2.3	3.6	5.0	2.3	1.5	.7	.8
Whooping cough	1.7	2.4	1.6	1.2	1.5	1.0	.6	.9
Mumps	1.6	1.8	1.4	1.4	1.7	7.4	.8	1.0
Chickenpox	2.4	4.0	2.7	4.1	4.7	4.0	.7	2.7

[1] The population used as a base for the rates is that of the 1930 Federal Census. The minimum number of cities reporting and the aggregate population were as follows: (1) Cities 100,000 and over: East, 23 cities, 13,867,534 persons; Central, 17 cities, 9,993,116 persons; West, 10 cities, 2,351,082 persons; South, 9 cities, 1,592,920 persons; (2) Cities 10,000–25,000: East, 83 cities, 1,398,549 persons; Central, 28 cities, 493,627 persons; West, 8 cities, 130,020 persons; South, 7 cities, 118,628 persons.

In 1934, the incidence of measles showed the same tendency, the only departure occurring in the rate in the small Western cities, which was lower than that of the cities of 100,000 population and over. The generally large excess observed in the small-city rates for measles in 1934 and 1935 (the single exception being that noted for the West) may be accounted for by the marked epidemicity of measles in the country as a whole in these years. In 1933, in the small cities of both the Western and Central regions, the measles rates were lower than in the large cities.

In the interpretation of these rates, the relative completeness of reporting in small and large cities must be taken into account. Investigations made by Godfrey (*4*) indicated that the ratio of reporting was much less complete in larger than in smaller cities. The higher incidence of communicable diseases in small cities included in the present survey may likewise reflect a more complete enumeration of illness in these communities.

In the group of acute diseases of the respiratory system, the leading causes of disabling illness among children under 15 years of age were tonsillitis, influenza, colds, pneumonia, and bronchitis; tonsillitis (including other pathological conditions of the tonsils and adenoids which preceded operation) was the most frequently reported of these diseases. The disabling illness rate for pneumonia was approximately of the order of the rate for scarlet fever, and several times higher than the rate for diphtheria. As a cause of death among children under 15 years of age, pneumonia is exceeded in frequency only by the group of congenital malformations and diseases of early infancy. On the basis of its frequency both as a cause of illness and death, pneumonia is one of the major diseases of childhood, ranking in importance with diphtheria and scarlet fever; yet the control of

this disease has been given relatively little attention by organized health agencies.

Because of the possibilities for their prevention, accidents represent another broad group of importance as a cause of disability in childhood. Accidental injuries involving disability of at least a week in duration were approximately as frequent among children under 15 years of age as certain of the communicable diseases of childhood. Accidents assume even greater importance when their high fatality rate is considered; among children 5 to 14 years of age, they account, on the average, for about one-fifth of all deaths.

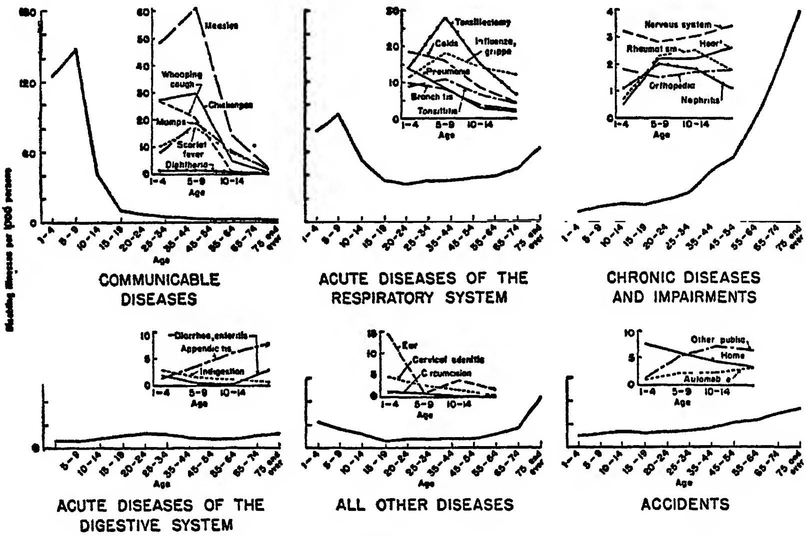

FIGURE 2.—Age variation in frequency rates of disabling illness in a 12-month period, classified by cause in broad disease groups (sole or primary causes only) and, for the period of childhood, by specific cause (sole, primary, and contributory causes). Conditions associated with the puerperal state, and diseases of the female genital organs are not included. Sample of 1,581,577 white persons in 31 cities of 100,000 population and over (exclusive of persons in families with income unknown) canvassed in 1935–36. The rates for infants under 1 year of age are not shown since the period of exposure was less than 12 months.

The diseases of children show a characteristically different frequency in the various periods of childhood. This may be observed in table 4 and figure 2, which show the frequency rates of disabling illness at specific ages of childhood for important diseases in each of five broad anatomic or etiologic groups. The data relate to a sample of surveyed children in the large cities.

The age trend of the frequency rates for the majority of the disabling diseases of children included in the two major groups, the communicable and respiratory, was definitely upward during the early years of life, approaching a maximum in the age period 5 to 9 years, and declining to a definitely lower level among children 10 to

14 years old. It should be noted, however, that these rates are based on the experience of white urban children; the age trend among rural and Negro children exhibits a different pattern (see footnote 8).

Among the communicable diseases, whooping cough represents an exception to this general trend, the frequency rate reaching a peak among children of the preschool ages. In Collins' study (*9*) of the age incidence of disabling and nondisabling illness, based on records obtained by the Committee on the Costs of Medical Care, the frequency of both whooping cough and measles was found to be higher among preschool children than in the age period 5 to 9 years.

In respect to the age incidence of measles and scarlet fever, the statements of other observers (*8*) are not supported by either the results of the present survey or Collins' analysis of the Committee's records. In both of these surveys, the ages under 10 years were found to include the period of highest incidence of measles, whereas the statement has been made previously that maximum incidence occurs at ages 5 to 14. The present survey and Collins' analysis indicate that scarlet fever is most frequent in the age period 5 to 9 years, a finding which is at variance with the designation of the preschool ages as the period of highest incidence of this disease (*8*). The incidence of the various communicable diseases at specific ages of childhood showed the same trend in samples of surveyed children in the intermediate and small cities; these rates are not shown because of the limitation of space.

In the respiratory group of diseases, tonsillitis (including tonsillectomies) and influenza occurred with greatest frequency in the age period 5 to 9 years. The frequency of pneumonia, however, was higher among preschool children than at ages 5 to 9.

Among other diseases showing a higher frequency among preschool children than in the age period 5 to 9 years, the diseases of the ear and mastoid process may be noted. Accidental injuries occurring in the home likewise were most frequent among children of the preschool ages. In the succeeding years of childhood, the frequency of home accidents declined but public accidents showed an upward trend.

Among infants born during the survey year, the acute diseases of the respiratory system considered as a group represented the major cause of disabling illness. As a cause of illness, this group of diseases outranked in frequency congenital malformations and other causes commonly designated as the diseases of early infancy, which are the leading cause of infant mortality. The acute respiratory diseases were more frequent causes of illness among infants than the acute communicable diseases; among children of preschool (1 to 4 years) and early school age (5 to 9 years) the relative importance of these two groups of diseases was reversed.

PREVALENCE OF PERMANENT ORTHOPEDIC IMPAIRMENTS

The illnesses of children considered in the preceding section were those which caused disability lasting for 7 consecutive days or longer in the survey year. It has been shown (table 1) that 12 in every 10,000 surveyed white children under 15 years of age had been disabled for a week or longer in the 12-month period by permanent orthopedic impairments. The severity of these cases is indicated by their mean duration, which was almost 8 months.

The survey included also an enumeration of cases of permanent orthopedic impairment which had caused no incapacity in the survey year, and cases resulting in disability of less than 7 consecutive days' duration. The combination of both nondisabling and disabling impairments, without limitation as to the duration of disability, makes possible the computation of the total prevalence rate of permanent orthopedic impairments. This total prevalence rate in children under 15 years of age was 49.5 per 10,000; at ages under 5, 25.6 per 10,000; at the school ages, 5 to 14 years, 59.3 per 10,000. These rates are shown in table 5, which relates to the experience of 602,814 white and colored children in 83 cities canvassed in the survey. Data now available do not permit the presentation of rates specific for color.

Among children under 15 years of age, the total prevalence rate of orthopedic impairments (49.5 per 10,000) is seen to be about four times as high as the rate for cases disabling for a week or longer (12 per 10,000). Thus, in about three-fourths of the orthopedic cases occurring among children under 15 years of age, the impairment had not seriously affected normal activity, insofar as this can be measured objectively at these ages. For children of school age, ability to attend school is a satisfactory measure of normal activity; among younger children, as has been noted previously, application of the criterion of "disability" by the layman may result in an understatement of disabling cases. It should be noted also that while only about one-fourth of the orthopedic cases among children under 15 years of age had suffered serious curtailment of the activities of childhood, a somewhat larger proportion of cases might be expected to result in a vocational handicap in adult life.

Figure 3 shows graphically the prevalence rates of orthopedic impairments classified according to the nature of the impairment and the part affected among children under 15 years of age; only rates of 0.5 per 10,000 or higher are shown here. It will be observed that, with the exception of lost fingers, impairments involving loss of members were relatively infrequent. On the other hand, the prevalence rates of crippling impairments without loss of the member, involving one or both lower extremities, upper and lower extremities in combination, and the trunk, were relatively high.

TABLE 5.—*Prevalence rate of disabling and nondisabling orthopedic impairments classified by the part affected and detailed cause, in two age periods of childhood—sole, primary, and contributory causes—602,814 white and colored children*[1] *in 83 cities canvassed in 1935–36*

Cause of impairment	Total, all impairments	Impairment without loss of member							Impairment with loss of member [4]				Impairment (with or without loss) of other or unknown members or parts of the body [5]	Number of impairments, all types
		Fingers	Toes	One hand or arm [2]	Both hands or arms [2]	One foot or leg [2]	Both feet or legs [2]	Upper and lower extremities [3] or trunk [2]	Fingers	Toes	One hand, arm, foot, or leg	Upper and lower extremities,[3] both hands or arms		
	Prevalence rate per 10,000 persons under 15 years													
All causes	49.5	1.7	0.3	5.9	0.5	15.3	6.9	8.7	4.9	0.6	1.1	0.1	3.5	2,982
Congenital [6]	16.0	.5	.2	2.3	.3	3.6	2.9	3.7	.6	.1	.6	.08	1.1	964
Acquired:														
Diseases, total	20.8	.1	-	1.7	.1	8.8	3.7	4.2	.08	.08	.05	.03	2.0	1,251
Poliomyelitis	11.6	.02	-	1.0	.05	6.1	1.6	1.9	-	.02	-	-	1.0	699
Paralysis, other forms	1.8	.02	-	.1	.02	.2	.3	.6	-	-	-	-	.6	111
Meningitis	.2	-	-	.03	-	.05	.07	.09	-	-	-	-	-	14
Encephalitis	.07	-	-	.02	-	.02	-	.03	-	-	-	-	-	4
Other mental and nervous diseases	.4	-	-	.05	-	.03	.03	.2	-	-	-	-	.05	23
Tuberculosis, all forms	.4	-	-	.03	-	.3	-	.1	-	-	-	-	-	25
Rheumatism	.3	.02	-	.05	-	.2	.03	.02	-	-	-	-	-	18
Other diseases of the bones and joints	1.6	-	-	.03	-	.6	.5	.3	-	.05	.03	-	.1	97
Weak arches	.7	-	-	-	-	.02	.6	-	-	-	-	-	-	39
Local infection	.3	-	-	.03	-	.2	.02	.02	.02	-	-	-	.02	15
All other specified diseases	.7	-	-	.05	-	.3	.1	.2	.03	-	.02	-	.05	45
Unknown or ill-defined diseases	2.7	.05	-	.2	.03	.9	.5	.8	.03	.02	-	.03	.1	161
Accidents and other external causes	12.7	1.1	.07	1.9	.05	3.0	.3	.9	4.2	.4	.5	-	.4	767

[1] The number of surveyed white and colored children under 5 years of age was 175,653; at ages 5 to 14 years, 427,161.
[2] Impairments of spine or back in combination with impairment of one or both upper or lower extremities are included with impairments of the extremities involved.
[3] Includes impairment of one hand or arm and one foot or leg; one hand or arm and both feet or legs; both hands or arms and one foot or leg; both hands or arms and both feet or legs.
[4] No cases involving loss of both feet or legs were reported.
[5] Includes impairments of specified parts of the trunk, except the joints, spine, back or side, and of unspecified parts of the trunk; and impairment (with or without loss of a member), in which the member or part of the body involved was not specified.
[6] Includes injuries at birth.

TABLE 5.—*Prevalence rate of disabling and nondisabling orthopedic impairments classified by the part affected and detailed cause, in two age periods of childhood—sole, primary, and contributory causes—602,814 white and colored children in 83 cities canvassed in 1935–36*—Con.

Cause of impairment	Total, all impairments	Impairment without loss of member							Impairment involving loss of member				Impairment (with or without loss) of other or unknown members or parts of the body	Number of impairments, all types
		Fingers	Toes	One hand or arm	Both hands or arms	One foot or leg	Both feet or legs	Upper and lower extremities or trunk	Fingers	Toes	One hand, arm, foot, or leg	Upper and lower extremities, both hands or arms		
	Prevalence rate per 10,000 persons under 5 years													
All causes	25.6	1.0	0.2	2.6	0.5	6.5	5.1	4.2	1.9	0.1	0.8	0.1	2.6	450
Congenital [4]	14.9	.5	.2	1.9	.4	3.4	3.1	2.6	.7	.1	.7	.06	1.1	261
Acquired:														
Diseases, total	7.2	.06		.3		2.4	1.9	1.3				.06	1.3	127
Poliomyelitis	3.1	.06		.2		1.4	.7	.3					.5	55
Paralysis, other forms	1.4			.06		.1	.2	.5					.5	24
Meningitis	.1					.06		.06						2
Encephalitis	.06					.06								1
Other mental and nervous diseases	.2						.06	.06					.06	3
Tuberculosis, all forms	.06					.06								1
Rheumatism														
Other diseases of the bones and joints	.9					.1	.6	.2					.06	16
Weak arches	.2						.2							4
Local infection	.06					.06								1
All other specified diseases	.2					.2							.06	4
Unknown or ill-defined diseases	.9					.3	.2	.2				.06	.1	16
Accidents and other external causes	3.5	.5		.4	.06	.7	.1	.3	1.2		.06		.2	62

	Prevalence rate per 10,000 persons 5-14 years													
All causes	59.3	2.0	0.3	7.3	0.5	19.0	7.6	10.6	6.1	0.8	1.2	0.1	3.8	2,532
Congenital[6]	10.5	.5	.2	2.5	.3	3.7	2.8	4.1	.5	.1	.5	.09	1.1	703
Acquired:														
Diseases, total	20.3	.1	----	2.2	.1	11.4	4.5	5.4	.1	.1	[illegible]	[illegible]	2.3	1,121
Poliomyelitis	15.1	----	----	1.4	.07	8.0	1.9	2.5	----	[illegible]			1.2	614
Paralysis, other forms	2.0	.02	----	.1	.02	.2	.3	.7	----	----	----	----	.7	87
Meningitis	.3	----	----	.05	----	.05	.09	.09	----	----	----	----	----	12
Encephalitis	.07	----	----	.02	----	----	----	.05	----	----	----	----	----	3
Other mental and nervous diseases	.5	----	----	.07	----	.05	.02	.3	----	----	----	----	.05	20
Tuberculosis, all forms	.6	----	----	.05	----	.4	----	.1	----	----	----	----	----	21
Rheumatism	.4	.02	----	.07	----	.3	.05	.02	----	----	----	----	----	18
Other diseases of the bones and joints	1.9	----	----	.05	----	.8	.5	.3	----	.07	.05	----	.2	81
Weak arches	.8	----	----	----	----	.02	.8	----	----	----	----	----	----	35
Local infection	.3	----	----	.04	----	.2	.02	.02	.02	----	----	----	.02	14
All other specified diseases	1.0	----	----	.07	----	.3	.2	.3	.05	----	.02	----	.05	11
Unknown or ill-defined diseases	3.4	.07	----	.3	.05	1.2	.6	1.0	.05	.02	----	.02	.1	115
Accidents and other external causes	16.5	1.4	.09	2.6	.05	3.9	.3	1.1	5.4	.6	.7	----	.5	705

Figure 3 also shows graphically the percentage distribution of orthopedic impairments among children under 15 years of age, by cause.[12] In the age group under 15 years, congenital defects, poliomyelitis, and injuries due to accidental causes accounted for 79 percent of all impairments which did not involve loss of the member; accidents alone accounted for 77 percent of all lost members.

Among children under 5 years of age, congenital defects and injuries at birth accounted for over half of the impairments reported. Children of school age (5 to 14 years) showed a relatively larger proportion of acquired impairments, a natural result of the progressive increase in exposure to disease and accident which occurs throughout life.

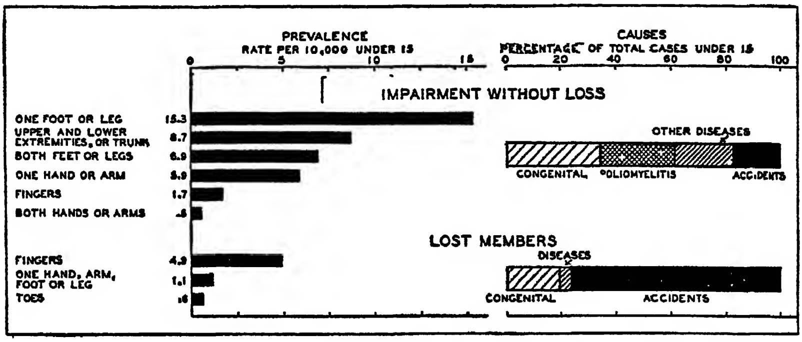

FIGURE 3.—Prevalence rate of disabling and nondisabling orthopedic impairments classified by the part affected, and the percentage distribution of impairments by cause, in 602,814 white and colored children in 83 cities canvassed in 1935–36—sole, primary, and contributory causes. The prevalence rates of impairments not shown here are as follows (rates per 10,000 persons under 15 years of age): Toes, impairment without loss, 3. loss of upper and lower extremities, both hands or arms, .1; impairment of unspecified part of trunk and other impairments of trunk, except those affecting the joints, spine, back, or side, 1.7; other impairments (with or without loss), the part involved not reported, 1.8. The combined prevalence rate of the impairments included in the last two groups is shown in column 13 of table 5. See also footnote 12 of the text.

Poliomyelitis was reported as the cause of 56 percent of all impairments due to disease among children under 15 years of age; in the age period under 5 years the proportion was 43 percent, and among children of school age, 57 percent. The prevalence rate of impairments due to poliomyelitis in children under 15 years of age was 11.6 per 10,000; for spastic and other forms of paralysis, except poliomyelitis, the rate was 1.8, for tuberculosis, 0.4, for rheumatism and other diseases of the bones and joints, 1.9 per 10,000. In comparison with poliomyelitis, other specific diseases are seen to be relatively infrequent as causes of orthopedic impairments.

[12] For the purpose of this distribution, the group of lost or impaired members or parts of the body in which the part affected was not specified (included in column 13 of table 5) was combined with "impairments without loss of member," since the method of coding these cases did not permit segregation of the lost members.

SUMMARY

In a canvass of 83 representative urban communities conducted by the United States Public Health Service in 1935–36, records of disabling illness in a 12-month period were obtained for 518,767 white children under 15 years of age. The records of sickness were limited to disabling illnesses, i. e., those which had prevented the usual activities of the preschool child, or school attendance of the school child, for at least 7 consecutive days in the 12-month survey period. The characteristics of the disabling diseases of childhood as observed in the survey may be summarized as follows:

Disabling illnesses occurred with greater frequency among children under 10 years of age than in any subsequent period except old age.

The duration of the average disabling illness was found to be lowest among children; as a result, childhood illnesses, although frequent in occurrence, gave rise to a relatively small volume of disability. The amount of disability accruing from illnesses disabling for 7 consecutive days or longer among children of preschool age (1 to 4 years) amounted to 7 days per capita; at ages 5 to 9 years, the rate was 8 days per capita. The lowest disability rate observed in childhood, 5 days per capita, was among children 10 to 14 years of age.

Except in the period of infancy, the rate of recovery from illness was notably higher among children than among adults.

Four in every five disabling illnesses occurring among children under 15 years of age were due to acute communicable or respiratory diseases; these diseases accounted for over half of the disability experienced by the average child in the 12-month period. Broadly considered, the control of the acute communicable and respiratory diseases represents the major problem in the field of child health, since many of these diseases are preventable.

Permanent orthopedic impairments incapacitated 12 in every 10,000 children under 15 years of age for at least a week during the survey year; the average duration of disability per case was almost 8 months.

On the date of the survey, permanent orthopedic impairments (including all cases without reference to the resultant incapacity) were found in 49.5 per 10,000 children under 15 years of age. Congenital defects, accidental injury, and poliomyelitis were reported most frequently as causes of impairments in this age period.

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Appendix

TABLE 1.—*Frequency rate of disabling [1] illness in a 12-month period, by age, in a sample of 2,152,740 white persons [2] in 83 cities; frequency rates of illness [1] according to termination, severity, and disability rates in a 12-month period, by age, in 280,073 white persons in 8 cities,[3] 1935–36*

Age period (years)	83 cities, sample	8 cities					
	Frequency rate of disabling [1] illness, total [2]	Frequency rate of disabling [1] illness with specified termination				Disability rate	Severity rate
		Total [5]	Recovery	Death	Incomplete [6]		
	Rate per 1,000 persons (at ages under 1, per 1,000 live births)					Days of disability per person	Days of disability per disabling [1] illness
All ages [4]	170	184	139	6.65	38.1	10.4	57
Under 15	225	249	220	3.16	25.6	6.4	26
Under 1 [7]	120	134	74	30.37	29.8	3.6	27
1–4	251	284	253	2.87	27.6	6.9	24
5–9	305	336	304	1.34	30.5	8.2	24
10–14	153	169	148	.92	19.4	4.9	29
15–19	107	117	98	1.48	17.0	4.7	40
20–24	148	154	132	1.45	20.6	6.4	42
25–34	151	161	133	1.73	26.0	7.3	46
35–44	136	147	109	3.40	34.6	9.3	63
45–64	155	170	104	10.45	55.3	15.2	89
65 and over	273	283	115	43.74	124.9	34.8	123

[1] Disabling for 7 consecutive days or longer in a 12-month period. All confinements, fatal, and hospital cases are included without reference to the duration of disability. Sole or primary causes only.
[2] Exclusive of persons of unknown age or unknown income.
[3] The 8 cities include: Atlanta, Ga.; Cincinnati, Ohio; Dallas, Tex.; Fall River, Mass.; Newark, N. J.; Oakland, Calif.; St. Paul, Minn.; Seattle, Wash.
[4] The rates for persons of all ages in 8 cities include a small number of cases and persons of unknown age; the rate for persons of all ages in 83 cities is exclusive of cases and persons of unknown age.
[5] Disabling illnesses (as defined in footnote 1) per 1,000 persons; this rate represents the sum of the rates for recovered, fatal, and incompleted cases.
[6] Disabled on the date of the canvass after an illness causing incapacity for at least 7 consecutive days.
[7] In the period under 1 year, the frequency rates are computed per 1,000 live births, the disability rate, per live birth.

OCULAR MANIFESTATIONS OF ARIBOFLAVINOSIS [1]

By H. D. Kruse, *Milbank Memorial Fund*, V. P. Sydenstricker, *Department of Medicine, University of Georgia Medical School*, W. H. Sebrell, *Surgeon, United States Public Health Service*, and H. M. Cleckley, *Department of Neuro-Psychiatry, University of Georgia Medical School*

This paper presents observations on ocular changes in a small group of patients known to be receiving insufficient riboflavin, and on the beneficial effects of riboflavin therapy on these lesions. From slit-lamp examination and ocular signs the principal manifestation was found to be a keratitis. The corneal lesions improved or disappeared upon riboflavin therapy, and recurred on cessation of it. Two cases of keratitis associated with syphilis but resistant to antisyphilitic treatment were studied without attempting to control the diet. Riboflavin therapy appeared to be distinctly beneficial in these cases.

OBSERVATIONS ON OCULAR LESIONS DUE TO ARIBOFLAVINOSIS

Nine adults, 17 to 53 years of age, with ariboflavinosis were studied. Five were colored females, 3, white females, and 1, a white male. All the patients had evidence of ariboflavinosis, both eye lesions and other lesions. When first seen only 4 were free from other deficiency disease; 5 had signs of one or more other deficiency diseases. These were associated with ariboflavinosis in the following combinations: Avitaminosis C; pellagra; pellagra and avitaminosis A; pellagra, neuritis, and anemia; pellagra, neuritis, anemia, and nutritional edema.

As regards etiology, all gave a history of generally deficient diets; but 5 showed, in addition, other factors contributing to inadequate intake or to disturbance in utilization of nutrients. These factors were, respectively, colitis with diarrhea, sore tongue and diarrhea, sore tongue and self-imposed diet limitation, sore tongue and anorexia, and syphilis.

During the period of observation, 6 patients were hospitalized and three were treated as out-patients. Hospitalized patients were maintained on a basal diet on which the oral lesions of ariboflavinosis were known to occur when supplemented with adequate amounts of other vitamins. Out-patients were advised not to change their home diets and to avoid yeast and cod-liver oil except as the latter was prescribed. The program in administering vitamin supplements was designed to demonstrate the lesions specific for ariboflavinosis and the sequence of changes in them. Most cases had multiple deficiency diseases calling for various supplements. First, there was administration of vitamins other than riboflavin, for they were not present in the basal diet in amounts sufficient for prompt and complete removal of other

[1] In addition to funds supplied by the three organizations with which the authors are affiliated, facilities available to the University of Georgia Medical School from a grant-in-aid by the John and Mary R. Markle Foundation also were used in the study.

avitaminosis occurring with ariboflavinosis. The daily supplements with the dosages usually administered were thiamin chloride, 20 mg.; nicotinic acid, 300 mg.; cevitamic acid, 50 mg.; and cod-liver oil, 4 cc.[2] The method of administration, as well as any increase in dosage, was governed by etiological factors and the severity of the associated deficiency disease.

These daily supplements to the basal diet served the following purposes: (1) To remove or prevent lesions of deficiency diseases other than ariboflavinosis; (2) to demonstrate what lesions are not beneficially affected and therein to show the lack of effect on lesions which might be attributable to ariboflavinosis; (3) to allow, if advisable, early lesions of ariboflavinosis to progress under observation; (4) to permit imminent subclinical ariboflavinosis to emerge upon curing other existing deficiency diseases. But the procedures varied mostly in the administration of riboflavin, as to the point when it was administered, the length of time it was given, and when it was withdrawn. (1) If riboflavin is withheld while the other vitamins are supplied, it is possible, as already stated, to follow the progress of early lesions in ariboflavinosis or to observe any lesions of ariboflavinosis which might emerge upon curing other existing deficiencies. (2) After other supplements had been administered for sufficient time to produce their effects, riboflavin in 5-mg. daily dosage was then administered to observe its effects on lesions and signs which might be attributable to ariboflavinosis. (3) In several instances riboflavin therapy was discontinued, after healing was near completion, to bring about recurrence. (4) In a few cases the alternate discontinuance and resumption of riboflavin therapy was repeated several times at suitable intervals, permitting appearance and disappearance of lesions.

Details of physical examinations and laboratory investigations, repeated at frequent intervals, are omitted from this paper and will form part of a future report. Frequent examinations with the slit lamp were made by 2 observers and their findings checked by an ophthalmologist. For 3 patients, the lamp was not available until shortly after they were sent to the hospital. Two patients, who had been noted to have ocular lesions in association with severe ariboflavinosis but who had been dismissed before a slit lamp became available, were recalled for observation. In all, the salient clinical signs of ariboflavinosis were followed.

Manifestations of riboflavin deficiency.—Signs of ariboflavinosis previously described include lesions of lips and face. Reddened, then shiny, denuded lips with maceration and fissuring in the angles of the mouth, designated as cheilosis, and seborrheic accumulations at the

[2] Thiamin chloride and riboflavin were the pure synthetic vitamins furnished by E. R. Squibb and Sons Merck and Co., and the Winthrop Chemical Co. Pure nicotinic acid was supplied by Merck and Co. and E. R. Squibb and Sons, cevitamic acid crystals by Mead Johnson and Co, and crystalline vitamin A for oral and parenteral administration by the Winthrop Chemical Co.

nasolabial folds have been described as manifestations of riboflavin deficiency (*1, 2, 3, 4*). To these two characteristics of ariboflavinosis, another should now be added. A specific type of glossitis can often be recognized before other signs of riboflavin deficiency are present. The tongue is clean, the papillae flattened or mushroom-shaped rather than atrophic, the color is definitely purplish-red or magenta as compared with the scarlet of nicotinic acid deficiency. Frequently the development of this type of glossitis can be observed in pellagrins whose red atrophic tongues have become normal in appearance under nicotinic acid therapy but whose diet has remained deficient in riboflavin. Thus cheilosis, seborrheic dermatitis, and glossitis are associated with riboflavin deficiency. In the present series of 9 cases, 7 showed cheilosis when first seen; in 2 it developed during the course of observation under therapy without riboflavin or with insufficient flavin. All these showed maceration and fissuring at angles of the mouth; in only 3 cases were there reddened denuded lips. Five cases showed typical glossitis of ariboflavinosis at onset and 3 later. Seborrheic accumulations were present in 2 cases when first seen, and developed in another later.

Ocular signs and lesions.—All had ocular changes for which there were symptoms and signs. Itching, burning, and a sensation of roughness of the eyes with mild photophobia were rather common complaints; severe photophobia, dimness of vision in poor light, and partial blindness were less frequent.

In 5 patients corneal opacities were grossly visible. Five cases showed congestion of the bulbar conjunctiva with marked circumcorneal injection. Such ciliary congestion usually accompanies diseases of the cornea, iris, and ciliary body. Associated with the bulbar congestion in these 5 cases was injection of the fornix conjunctivae, a relationship not uncommon in severe disturbances of the anterior part of the eye. Three cases showed injection only in the palpebral conjunctiva and fornix, indicative of conjunctival involvement. Most of the cases showed impaired visual acuity by test. No definite abnormalities in the fundi were seen upon ophthalmoscopic examination.

Slit-lamp examinations, however, were most revealing. The outstanding changes were in the cornea. These are most lucidly and succinctly presented by a composite description of the observations with the instrument on the 9 patients. When the patients were first examined, their corneal manifestations were in various stages. But some notion of the sequence of events was gained in the following ways: (1) In one instance ariboflavinosis with ocular as well as other signs developed upon curing other existing deficiency diseases; (2) early cases of ariboflavinosis were allowed to progress; (3) lesions of

ariboflavinosis after being healed were allowed to recur under observation.

The earliest change noted was superficial invasion of the cornea by capillaries arising at either or both the nasal and temporal side of the limbus from the anterior ciliary vessels, while later the capillaries extended into the substantia propria of the cornea. There were anastomoses between the capillaries arising from widely separated sectors of the limbus. Accompanying the vascular proliferation, the ciliary vessels encircling the limbus were dilated and engorged. Still later extensive interstitial infiltration with exudate appeared. Both superficial and interstitial opacities, sometimes diffuse, sometimes patchy, were seen after vascularization was well under way. It is evident that active cases in various stages may, when first seen, present combinations of these features. In 3 cases there was evidence of an old iritis, with the structure and color of the iris changed by exudate.

As in other deficiency diseases, in ariboflavinosis these histopathological changes in the cornea are reversible. Riboflavin therapy to active cases brings about almost complete effacement of the lesions. In the process of healing the capillaries become occluded and may show interrupted columns of blood, sometimes mere "beads" of trapped corpuscles. All vessels may become empty though still easily visible and may undergo progressive diminution in size. There is resolution of exudate. Both superficial and interstitial opacities clear to a marked extent.

When riboflavin therapy is discontinued after the healing process is near completion, there is recurrence of the corneal lesions. Capillaries which had become occluded during the period of treatment become patent and filled with circulating corpuscles. The opacities likewise recur during relapse.

Examination of two patients recalled 1 year after cure of ariboflavinosis showed residua in the cornea in the form of numerous empty capillaries and old superficial and interstitial opacities. Whether these occluded capillaries would disappear after vigorous therapy cannot now be said. Nor have we studied the therapeutic effectiveness of riboflavin on opacities of long standing such as may be found in neglected or arrested but incompletely healed cases.

By the several procedures in supplying supplements, it was found that the corneal lesions, the ocular signs and symptoms, cheilosis, characteristic glossitis, and nasolabial seborrhea were not benefited by nicotinic acid, thiamin, cevitamic acid, cod-liver oil (or crystalline vitamin A), but were by riboflavin. The ocular lesions and signs reappeared, usually with cheilosis and glossitis also, upon discontinuance of the riboflavin therapy and again disappeared following riboflavin therapy.

As representative in showing the specificity of the eye, lip, and tongue lesions for ariboflavinosis and the sequence of the corneal changes, 2 of the 9 case reports are presented here briefly.

The first case, a colored female 27 years of age, had ariboflavinosis complicated with pellagra and avitaminosis A. Upon admission she had diarrhea, emaciation, cheilosis, photophobia, circumcorneal injection with congestion of the bulbar and fornix conjunctiva, and corneal opacities. Daily supplements of nicotinic acid, 1,000 mg., and liver extract, 60 cc., were started. After 6 days cheilosis and ocular congestion had disappeared, so liver extract was discontinued. Two months later follicular keratosis of avitaminosis A appeared but responded to daily therapy of percomorph oil, 2 cc. One month thereafter cheilosis recurred; therefore riboflavin, 5 mg. daily, was given. On slit-lamp examination the corneae showed slight superficial and old interstitial opacities. A plexus of empty capillaries extended from the limbus to the area of interstitial opacity. For 10 weeks there was no change, then riboflavin therapy was discontinued. Sixteen days later severe cheilosis and glossitis occurred and during the next 12 days many of the capillaries, extending in the cornea from the ciliary plexus to the opacity, had become patent and contained blood. Riboflavin, 15 mg. daily by mouth, was resumed. In 5 days there was healing of the cheilosis and glossitis. All the capillaries in the right cornea were again occluded, and in the left cornea, though many capillaries there were patent, many others were empty and still others showed interrupted columns of blood. One week later all corneal capillaries were occluded, though many in the left eye contained "beads" of trapped corpuscles. Visual acuity at this time had improved from 15/40 to 15/20.

Case G. S., a colored female 19 years old, had been admitted twice previously for "keratitis and iritis, cause undetermined." On present admission her eyes showed extreme photophobia, swollen lids, seropurulent exudate, conjunctival and circumcorneal injection, and corneae so opaque that pupils could barely be seen. She also had cheilosis, and extensive and severe seborrheic dermatitis and glossitis typified by a magenta-colored tongue with flattened papillae. While she was on the control diet for 11 days, the seborrheic and ocular manifestations showed no improvement; the cheilosis and glossitis became somewhat worse. Daily supplements of thiamin chloride, nicotinic acid, cevitamic acid, and cod-liver oil were then prescribed in amounts previously cited. Upon slit-lamp examination 4 weeks later there was universal vascularization of both corneae, with numerous anastomoses between many capillaries arising from various sectors of the ciliary vessels, extensive interstitial infiltration, and extreme superficial and interstitial opacities. There was evidence of an old and recent iritis. The cheilosis, seborrheic dermatitis, and glossitis were unchanged.

At this point riboflavin (5 mg.) was given intramuscularly each day. Four days later the cheilosis was healed; the tongue was pink with some coating. As for the eyes, the photophobia was much less and the gross injection of conjunctival vessels was absent. Slit-lamp examination showed marked diminution in the number of minute vessels in the cornea and some resolution of interstitial opacities. Six days thereafter the keratitis was much improved. Most of the superficial and interstitial vessels had become empty or "beaded," and the opacities had so cleared that the fundus could be seen for the first time. Riboflavin was then discontinued. Eight days later cheilosis and glossitis recurred. Six days thereafter almost all the corneal vessels which had become occluded during riboflavin therapy were now patent with circulating blood and the interstitial opacities relapsed. Riboflavin therapy (5 mg. daily by mouth) was resumed. In 18 days the cheilosis and glossitis had disappeared but corneal vascularization persisted.

But after 18 more days only the larger superficial vessels remained patent, and interstitial opacities, which had cleared on previous riboflavin treatment but recurred on discontinuance of therapy, had now again disappeared. At this time crystalline vitamin A (20,000 units daily) was substituted for fish liver oil, all other supplements including riboflavin being continued. Twenty-four days later the vascularization showed no change but the opacities had cleared further. Riboflavin therapy was withdrawn at this point. In 9 days there was photophobia and both superficial and interstitial vessels in the cornea became patent and in increased numbers showed circulating blood. Twelve days later photophobia and corneal opacities were greatly increased; cheilosis and glossitis had also recurred. Riboflavin therapy (15 mg. daily by mouth) was again resumed In 4 days the cheilosis and glossitis had disappeared. Seven days later photophobia was absent; almost all the vessels in both corneae were empty; the superficial and interstitial opacities in the corneae were less than on any previous occasion. Visual acuity which had been found to be 20/40 in the right eye and 20/100 in the left eye at the first examination, possible only after the eyes cleared, improved to 15/20 in both eyes.

OBSERVATIONS ON OCULAR LESIONS ASSOCIATED WITH SYPHILIS

Patients were selected who presented severe interstitial keratitis which had ceased to improve under continuous antisyphilitic therapy. Since these were outpatients, no effort was made at dietary control, but all antisyphilitic medication was stopped. Two patients were given riboflavin, 2 others who served as controls were given tablets of acetylsalicylic acid. All were examined with the slit lamp once each week.

Case 11, a white girl, aged 9, with a diagnosis of congenital syphilis, had been under continuous antisyphilitic treatment for 15 months. Her severe keratitis had shown no improvement during the preceding 3 months. At the end of this time she had marked photophobia and lacrimation; both corneae were grossly clouded. The slit lamp showed that the entire cornea was covered with fine interlacing and anastomosing vessels located just beneath the epithelium. There was extensive interstitial invasion and the posterior membrane was also covered with a fine vascular plexus. Superficial and interstitial opacity was present in each cornea, several areas of dense opacity occurring especially in the substantia propria. Marked changes in the iris and the presence of many fine deposits on the posterior surface of the cornea gave evidence of an associated uveitis. All antisyphilitic treatment was stopped and riboflavin (5 mg. daily) was given. Nine days later it was evident that the diffuse interstitial opacity was less and that many of the smaller vessels were empty. Three weeks thereafter photophobia was absent and the opacities had cleared to such a degree that the child was reading without her glasses At this time great numbers of small corneal vessels were empty and several of the larger ones showed interrupted columns of blood. One month later the right cornea was grossly clear. By slit lamp, however, there was moderate anterior opacity, and some residual interstitial opacity, more in the left than in the right eye. The vascular changes were also improved. Only a few of the smaller vessels in each cornea remained patent; the majority of the larger vessels showed interrupted columns of blood. There were scattered interstitial exudates. The fine deposits on the posterior surface of the cornea remained unchanged, a few of the minute vessels in each cornea remained patent, the majority of large vessels showed interruption of the columns of blood. Two weeks

later there was no evident change in the opacities but further obliteration of vessels was noted. Various observers pronounced the improvement during the 12 weeks of riboflavin therapy as extraordinary.

Case 12, a colored female, aged 24, with a diagnosis of acquired syphilis, had been previously treated with antisyphilitics at various times, but for 5 months the treatment had been continuous and intensive. No improvement had been noted in the keratitis during the preceding month. Examination with the slit lamp showed a picture comparable in most respects to that described for case 11. The distribution, number, and size of the vessels were remarkably similar, but the interstitial opacities were somewhat denser. The fine deposits on the posterior surface of the cornea were more numerous. Antisyphilitic treatment was stopped and riboflavin (5 mg. daily) was given. There was obvious resolution of anterior and interstitial opacities by the end of the second week of treatment and a notable decrease in the number of blood vessels which had invaded the cornea. As in the previous case there was thereafter progressive obliteration of vessels and clearing of anterior and interstitial opacities. Two and a half months later no patent vessels could be found and only a few small areas of interstitial exudate remained. The fine deposits on the posterior surface of the cornea persisted. The degree of improvement in the eyes in this case was also remarkable.

Case 13, a colored female, aged 16, with a diagnosis of congenital syphilis, and case 14, a white male, aged 26, with a diagnosis of acquired syphilis, presenting keratitis similar in severity to that of cases 11 and 12, had shown no improvement from antisyphilitic therapy for 2 months. Treatment was withdrawn and acetylsalicylic acid given. During the subsequent two and one-half months there was no appreciable change in the condition of the cornea in these control cases.

DISCUSSION

At least six lines of evidence point to keratitis as a specific manifestation of ariboflavinosis. (1) Keratitis appeared in persons whose diets, at home or in the hospital, were deficient in riboflavin; it persisted or grew worse on a basal diet deficient in riboflavin. (2) It was not cured by thiamin chloride, nicotinic acid, cevitamic acid, crystalline vitamin A or fish liver oils. (3) It was cured by riboflavin. (4) It relapsed upon withdrawal of riboflavin therapy. (5) It occurred with other signs of ariboflavinosis, namely, cheilosis, glossitis, and seborrheic dermatitis; but, more important, it corresponded with them in progression or regression, according to discontinuance or administration, respectively, of riboflavin. (6) It has an analogue in ariboflavinosis experimentally produced in animals. As for the interstitial keratitis associated with syphilis, the rapid and almost complete response to riboflavin therapy in the two cases suggests that there may be a riboflavin involvement.

Using a slit lamp as well as injection methods, Bessey and Wolbach (*5*) observed vascularization of the cornea as an early sign of ariboflavinosis in the rat, then infiltration and opacities after a longer deprivation of the vitamin. As soon as 12 hours after riboflavin administration by mouth, opacity of moderate degree disappeared, and within 48 hours the cornea, unless severely damaged, was clear. Later there was resolution of exudate and gradual occlusion of the

corneal vessels until they were no longer visible by slit-lamp illumination, though they could be demonstrated by india-ink injection. They persist demonstrable only by injection in apparently normal corneas for a long period. Similarly, it may be mentioned that interstitial keratitis due to syphilis is said to leave evidence in later years of its previous occurrence; the slit lamp reveals delicate opaque lines representing obliterated blood vessels In 109 patients with leiodystonia and sprue, Pock-Steen (*6*) noted eye symptoms, the principal one being reduced visual acuity in dim light. This twilight-blindness, which he calls aknephascopia, was greatly ameliorated after riboflavin administration and was therefore regarded as a specific sign of ariboflavinosis. It differs from night-blindness and is not influenced by administration of vitamin A. It is interesting that he lists mydriasis, conjunctival irritation, keratitis, and disturbances in accommodation as other eye conditions observed in sprue; of these only conjunctival pains were mitigated by riboflavin. These eye symptoms of sprue, he believes, result partly from riboflavin deficiency and partly from histamine toxicosis. In the abstract no mention is made of a study of ocular lesions which might be associated with the diminished vision. Still another group of investigators (*4*), in reporting on 6 cases of ariboflavinosis with cheilosis, mentioned that one case showed conjunctival congestion and photophobia which responded to riboflavin.

Keratitis in human beings due to riboflavin deficiency has not been previously reported. As in most nutritive disturbances, deficient diet is not the only possible causative mechanism. It is probable that insufficient intake and disturbance in transport or utilization in the body may lead to the same result, and that these several mechanisms may operate simultaneously. In the nine dietary cases here reported, it is probable that the anorexia of several, the pellagric diarrhea of others, and the colitis in still another contributed with the deficient diet to the bodily deprivation of riboflavin. It is likewise probable that Pock-Steen's patients with sprue did show ariboflavinosis attributable to poor absorption if not also to deficient diets.

In the association between syphilis and keratitis, there are three possibilities: (1) Syphilis may have no causal relationship to keratitis; their association may be a pure coincidence. With evidence that interstitial keratitis arises from deficienicy in riboflavin, it may be questioned whether keratitis occurring with inherited syphilis is actually due to syphilis or to other causes. That interstitial keratitis has, in the past, been most frequently noted in association with syphilis is suggestive but not conclusive evidence that it arises from syphilis. True, interstitial keratitis attributed to syphilis could conceivably occur through involvement of riboflavin. As an infectious process, syphilis could, directly or indirectly, act through a mechanism which would affect nutrition, namely, by disturbance of utilization.

(2) Syphilis may be a contributing or precipitating cause of keratitis. In this event, when the body is in a satisfactory nutritive state, particularly with respect to riboflavin, and other causes are not operating, no corneal involvement with syphilis would be expected. But if the bodily state with reference to riboflavin is mildly but imperceptibly impaired from a cause such as ariboflavinosis, corneal involvement might be expected with syphilis. Or syphilis, though not inducing lesions in the cornea, may make bodily tissues more sensitive to subsequent deficiency or disturbance in riboflavin. Under either circumstance syphilis could not produce keratitis but could contribute to it or precipitate it. That interstitial keratitis is said to occur only in a portion of cases with congenital syphilis would accord with this possibility but would not prove it. If syphilis has this relation to keratitis, administration of flavin might be expected to prevent corneal lesions.

(3) Syphilis may be a primary cause of keratitis. Here, regardless of a satisfactory nutritive state with respect to riboflavin and the absence of other causes, corneal involvement might be expected from syphilis. In this event keratitis should occur in a greater proportion of congenital syphilis cases. If congenital syphilis were the sole primary cause in a case, it would be helpful to know whether administration of riboflavin in generous amount in the very early stages of the keratitis, while the process was progressive, might mitigate the corneal lesions, particularly along with appropriate antisyphilitic therapy. But assuming syphilis to be a primary cause, other causes may operate simultaneously with it. Indeed, in a case of keratitis with syphilis, it may be questioned how much arises from syphilis and how much from ariboflavinosis or other causes. Diets consumed by infants and children with keratitis associated with syphilis may be and probably often are deficient in riboflavin and add to the severity of the eye lesion. When the progress of the keratitic process has halted because the cause, whatever it is, has abated or disappeared, whether corneal repair occurs would seem to depend on the riboflavin which the body receives, usually in the diet. It is proverbial that the effective therapeutic dose of vitamins is many times larger than the amount for maintenance, often larger than the amount supplied by diet. Hence, if the diet were low in riboflavin, repair might be much delayed, if not indefinitely postponed. What has been said concerning syphilis in relation to interstitial keratitis may apply similarly to tuberculosis and interstitial keratitis.

Keratitis is usually classified as interstitial or superficial. The keratitis associated with syphilis or tuberculosis has long been regarded as the classic example of the interstitial type. It takes its name from cellular infiltration in the deep layers of the cornea. But this represents the description of one feature in the advanced stage.

The two cases with syphilis and several of the dietary cases here reported were likewise in this fully developed stage. By that time vascularization and infiltration with opacity are both superficial and deep as well as extensive in area. Indeed they may spread to involve the whole cornea. Actually interstitial keratitis may be more readily understood from studying the sequence of details in its development, as has been done in the dietary variety. In describing the ocular histopathology of ariboflavinosis in rats, Bessey and Wolbach (*5*) pointed out that the capillaries proliferate first beneath the corneal epithelium, then extend deep in the tunica propria and far toward the center of the cornea. Several early cases of keratitis in humans on a dietary basis, as reported in the present paper, bear out that superficial vascularization is an initial change. Later, they state, leucocytic infiltration accumulated beneath the corneal epithelium, and still later in the central nonvascularized portion of the cornea. Thus, the keratitic process extends downward and soon involves the whole cornea. However, the integrity of the corneal epithelium, which is linked so closely with vitamin A, is disturbed only in the very late stages by the progression of ocular lesions in ariboflavinosis.

As regards superficial keratitis, evidence from three sources shows its common features, its mode of progression, and the nutritive factors involved. In the first group of conditions it starts as a conjunctivitis which in its course involves the cornea. There may be pannus, i. e., vascularization and infiltration. Or there may be ulceration from infiltration of a circumscribed portion of the cornea which may advance in area and depth with loss of substance. Either pannus or ulcer produces opacities. Both occur in phlyctenular keratitis and in trachoma. Ulcers also occur in the course of conjunctivitis on a bacillary basis. Secondly may be considered the manifestations of avitaminosis A in humans, namely, xerophthalmia and keratomalacia. Here again, the conjunctiva is affected first. Not only it but also the corneal epithelium undergoes keratinizing metaplasia resulting in xerosis of these structures. The pathological process extends downward through the corneal epithelium to involve the cornea with softening (keratomalacia), ulceration, and opacity. Thirdly, among the effects of avitaminosis A in rats, Wolbach and Howe (*7*) noted not only hyperkeratinization of corneal epithelium but also vascularization of the cornea accompanied by infiltration. After reviewing this material Bessey and Wolbach (*5*) argued that since the ingrowth of capillaries took place concurrently with epithelial changes and prior to any appreciable inflammatory response, it was not explainable on the latter grounds. Apart from the hyperkeratinization of the corneal and conjunctival epithelia, they found great similarity in nature between the ocular lesions of avitaminosis A and ariboflavinosis.

The former, however, responded to vitamin A. As the processes in conjunctivitis or avitaminosis A extend through the corneal epithelium and down into the cornea, it is not surprising that they disturb the cornea with a typical, but probably secondary, response like that seen in ariboflavinosis. Since the site of the first reaction of riboflavin is just beneath the corneal epithelium, it is possible to conceive how riboflavin may thus be secondarily disturbed.

These foregoing observations are helpful in differentiating the pathogenesis of the superficial and interstitial types of keratitis, particularly in their relation to avitaminosis A and ariboflavinosis, respectively. Interstitial keratitis, in advancing, may involve the whole cornea. It results from a deficiency or disturbance in riboflavin. In this process the corneal epithelium, linked with vitamin A, may be involved secondarily in the very late stages. Superficial keratitis, on the other hand, follows by extension a primary involvement of the conjunctiva. It is brought about by infection, with probable disturbance in vitamin A, or by avitaminosis A. As the process reaches the lamellae just under the corneal epithelium, it is possible that the keratitic manifestation represents a secondary riboflavin disturbance. In consequence, avitaminosis A concurrent with ariboflavinosis might be expected to add to the extent or intensity of the keratitis due to the ariboflavinosis.

Keratitis is the principal ocular lesion of ariboflavinosis, but associated signs indicate involvement of neighboring structures. In all cases there was a pronounced circumcorneal injection. At first glance it may be mistaken for conjunctival injection, particularly since it often also involves the latter, but careful examination reveals the prominence of the circumcorneal distribution. Circumcorneal injection, indicative of ciliary congestion, is known to occur in diseases of the cornea, iris, and ciliary body. Keratitis with syphilis is usually associated with inflammation of the uveal tract; indeed, by some, keratitis is regarded as merely a part of a uveitis. In mild cases only the iris is involved, but in more serious types also the ciliary body. In the two cases with syphilis reported here, changes in the iris, keratic precipitates, and synechia indicate uveitis. It is not unlikely that the ciliary congestion is due to involvement of the uvea. As has been stated, in these patients riboflavin therapy cleared the ciliary congestion along with the corneal lesions. It had no beneficial effect on the keratic precipitates, but judgment on this point should be reserved until there are observations over a longer period. In the ariboflavinosis cases there was likewise ciliary injection, cleared by riboflavin. In some instances the iris also showed change. Thus there was a mild iritis accompanying the keratitis. Although keratic precipitates were not present, it is not known whether ariboflavinosis with very severe keratitis over a protracted period would also show

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uveitis. In brief, whereas uveitis was associated with keratitis and syphilis, mild iritis with circumcorneal injection as its most marked and frequent sign was often associated with keratitis from ariboflavinosis.

Although circumcorneal injection in the ariboflavinosis cases was constant and pronounced, conjunctival congestion also frequently occurred. In most the fornix was injected, but with less intensity than the circumcorneal area; in a few the palpebral conjunctiva was also congested. In one case there was a mucopurulent discharge. Thus conjunctivitis occurred, but in only one case was it pronounced. It should be recalled that the conjunctivitis is the primary step in the development of superficial keratitis. On the other hand, mild conjunctivitis was common; often congestion was the only sign. It was probably secondary to iritis, for if circumcorneal congestion is intensive in iritis, it also involves the conjunctival vessels.

We are at present extending our series of cases in order to obtain further observations on details in the sequence of events as well as on some of the points discussed. Especially with reference to interstitial keratitis associated with syphilis, we hope to obtain further evidence, as opportunity provides, on the beneficial effects of riboflavin.

SUMMARY

Nine patients with other symptoms of riboflavin deficiency developed ocular lesions. Slit-lamp examinations and ocular signs revealed that the principal manifestation was a keratitis. The corneal lesions improved or disappeared upon administration of riboflavin and reappeared on cessation of riboflavin therapy.

In addition to cheilosis and seborrheic dermatitis already known to be characteristics of ariboflavinosis, a specific type of glossitis was also observed in these patients. This glossitis, like the cheilosis, seborrheic dermatitis and keratitis, also disappeared upon riboflavin treatment and recurred upon cessation of therapy.

Two patients with severe interstitial keratitis associated with syphilis showed very marked improvement while under therapy with riboflavin.

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ORIGIN OF INDUCED PULMONARY TUMORS IN STRAIN A MICE [1]

By Hugh G. Grady, *Research Fellow*, and Harold L. Stewart, *Pathologist, United States Public Health Service*

Since the first recorded description of a spontaneous pulmonary tumor in a mouse was made over 40 years ago many histologic studies of these growths have appeared in the literature, but no clear-cut evidence as to their mode and site of origin has been forthcoming. Within recent years the striking susceptibility of strain A mice to the development of lung tumors, especially after the administration of carcinogenic hydrocarbons, has been repeatedly noted. Moreover, no essential histologic differences have been observed between the spontaneous and induced tumors. Consequently a study was outlined in which serial sections of the lungs of strain A mice injected with carcinogenic hydrocarbons could be examined during the period of tumor development.

Two hundred strain A mice, 2½ to 3 months of age and equally divided as to sex, were used. One hundred mice received 0 8 mg. of 1:2·5:6-dibenzanthracene in 0.8 cc. of lard subcutaneously; 60 mice received 1.6 mg. of methylcholanthrene in 0.4 cc. of lard subcutaneously; 40 mice received 0.8 cc. of lard and served as controls. Animals which developed tumors at the site of injection, or which died as a result of hemorrhage, infection, or any other cause, were not included in this study. The final effective number consisted of 130 mice injected with the carcinogens and 30 control animals. The animals were sacrificed daily (except on Sundays and holidays) over a period of 3 months, 98 being killed between the twenty-sixth and sixtieth days. In all animals the lungs were fixed *per tracheam* in Zenker's fluid and the entire right lower lobe sectioned in series. The remaining lung tissue was embedded in paraffin and kept in reserve. Sections were routinely stained with eosin-methylene blue and Masson's trichrome technique. Foot's method for reticulum, phosphotungstic acid hematoxylin, and Giemsa's methods were also used on occasion.

The earliest recognizable pulmonary tumor was found 32 days after injection of methylcholanthrene and 36 days after the injection of 1:2:5:6-dibenzanthracene. No difference in the character of the

[1] Abstract of an article entitled "Histogenesis of Induced Pulmonary Tumors in Strain A Mice" (publication pending).

tumors produced by the two hydrocarbons was observed. From the fortieth day onward tumors were found with increasing frequency. All tumors examined appeared to be adenomatous growths and were histologically similar to those previously described as induced tumors. They also resembled closely the spontaneous lung tumors of mice. Few were connected with the bronchial epithelium at any point. Practically all the early growths could be seen to arise from the alveolar wall when followed in complete serial sections. Immediately preceding the development of tumors and accompanying the early stages of their formation was a notable proliferation of large mononuclear cells from the alveolar walls. Frequently they would form columns of varying length partly or completely lining the alveolar space, or they might coalesce to form small groups. These groups might project into the alveolar lumen or occur within or on the septal wall. The adenomatous nodules developed through a combination of these processes but when developed they were remarkably uniform in appearance. The recognizable tumor was composed of more or less closely packed columns of columnar or cuboidal cells with relatively large nuclei. The sparse stroma was furnished by the alveolar septal walls. No recognizable inflammatory lesions were encountered either prior to or concomitant with the development of the tumors.

CONCLUSIONS

Pulmonary tumors induced in strain A mice arise from alveolar cells and begin to appear 5 weeks after subcutaneous injection of carcinogenic hydrocarbons.

The development of these tumors in the lung is not associated with any demonstrable inflammatory reaction.

COURT DECISION ON PUBLIC HEALTH

Recovery allowed for occupational disease contracted by employee.—(Indiana Supreme Court; *Illinois Steel Co.* v. *Fuller*, 23 N.E.2d 259; decided November 6, 1939.) An action was brought to recover damages because of an occupational disease (benzol poisoning) which was alleged to have been contracted by an employee through the negligence of the employer. Liability was asserted under the State employers' liability law and negligence was based upon charges of violations of statutory provisions requiring an employer to supply serviceable gas masks and to provide sufficient means of ventilation.

The title and body of the employers' liability law purported to make it applicable to liability for injuries rather than to accidental injuries, and the supreme court, in deciding that an action on account

of occupational disease occurring prior to the enactment of the 1937 Indiana Workmen's Occupational Diseases Act could be maintained under the liability law, stated as follows:

* * * The word "injury" is a generic term of broad designation. As applied to the human body, it may result from other causes than trauma. Disability from an occupational disease may be no less an injury than one resulting from accident. While the applicability of the Employers' Liability Law to occupational diseases does not seem to have been specifically considered by this tribunal, in at least three cases judgments obtained thereunder have been sustained by our appellate court. [Cases cited.] In the last mentioned case that court said: "It is the contention of appellee that her decedent died as the result of an occupational disease * * * as a proximate result of appellant's negligence and failure to comply with the Employers' Liability Act, *supra*. If appellee's contention is correct, then her remedy for redress would be under the common law as supplemented by the Employers' Liability Act, and not by resort to the Workmen's Compensation Act. * * *"

The statute on gas masks required employers of workmen employed in any enclosed room or structure in which there may be dangerous, noxious, or deleterious gases, "to supply such workmen with serviceable gas masks, to be worn while such work is being performed". The ventilation statute provided that "there shall be sufficient means of ventilation provided in each workroom of every manufacturing or mercantile establishment". The employer urged that the requirements that it supply "serviceable gas masks" and provide "sufficient means of ventilation" were so vague, indefinite, and uncertain as to be unenforceable and that to enforce these provisions would result in a denial of due process of law and would amount to an unconstitutional delegation of legislative power to courts and juries. The supreme court said that it found no basis for the claim that these statutes were unconstitutional and, respecting this point, used in part the following language:

* * * When it is asserted that a statute is so indefinite that its enforcement would result in a denial of due process or amount to an unauthorized delegation of legislative functions, the court must consider the enactment in the light of the problems with which the legislature was undertaking to deal. Meticulous exactitude and absolute precision is rarely attained, nor is it required, in the drafting of statutes of this character. It may be observed that in the adoption of the gas mask and ventilation statutes here under consideration, the general assembly was undertaking to impose safety measures with respect to factories, establishments, and industries of many kinds. For example, masks that would be serviceable and a means of ventilation that would be sufficient in a gaseous mine might be wholly unsuited or inadequate in a factory where poisonous chemicals or explosives were manufactured, or vice versa. It would, no doubt, be impossible to prescribe by law definite specifications as to what particular type of gas mask or what peculiar means of ventilation would be serviceable and sufficient under all the varying circumstances to which these acts are applicable; and if there is an inflexible and comprehensive rule for determining when statutes of the character of those now under consideration meet the requirement of due process, our attention has not been called to it. Perhaps it is enough to say that such statutes are valid when

they clearly designate the dangers and hazards against which the legislature sought to provide protection and reasonably indicate the means or methods by which that is to be accomplished.

The appellate court, after considering certain other contentions of the employer regarding the evidence in the case, affirmed the judgment of the trial court in favor of the appellee (employee).

DEATHS DURING WEEK ENDED JANUARY 6, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Jan. 6, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,250	9,142
Average for 3 prior years	10,027	
Deaths under 1 year of age	566	567
Average for 3 prior years	607	
Data from industrial insurance companies:		
Policies in force	66,416,327	68,314,978
Number of death claims	10,204	9,375
Death claims per 1,000 policies in force, annual rate	8.0	7.2

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JANUARY 20, 1940

Summary

Although the number of influenza cases reported continued to increase, the rate of increase dropped sharply during the week ended January 20, and was only less than ½ of 1 percent, as compared with 30 and 36 percent for the 2 preceding weeks, respectively. For the current week 12,568 cases were reported, as compared with 12,516 for the week ended January 13, with 9,630 for the week of January 6, and with 3,144 for the corresponding median week of the 5-year period 1935–39.

The highest incidence is still shown in the South Atlantic and South Central groups of States, which reported 11,095 cases, or approximately 88 percent of the total. The New England States appear to remain comparatively free from the disease, and the other areas show no significant epidemic tendency.

Mortality figures for the large cities are not available for the current week, but 9,716 deaths were reported for the week ended January 13, as compared with 9,250 for the preceding week, an increase of 466, and with 9,824 for the 3-year average for the corresponding weeks of 1937, 1938, and 1939.

No unusual incidence is shown for any of the other eight important communicable diseases which are included in the weekly telegraphic reports.

The following reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

In these and the following tables, a zero (0) indicates a positive report and has the same significance as any other figure, while leaders ( ) represent no report, with the implication that cases or deaths may have occurred but were not reported to the State health officer.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 20, 1940, and comparison with corresponding week of 1939 and 5-year median

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	Jan. 20, 1940	Jan. 21, 1939		Jan. 20, 1940	Jan. 21, 1939		Jan. 20, 1940	Jan. 21, 1939		Jan. 20, 1940	Jan. 21, 1939	
NEW ENG.												
Maine	0	6	4	30	2	4	105	5	102	0	0	0
New Hampshire	0	0	1				20	0	22	0	0	0
Vermont	0	0	0				13	3	7	0	0	0
Massachusetts	15	5	6				210	427	370	0	1	1
Rhode Island	0	0	1				125	1	25	0	0	0
Connecticut	6	3	5	4	13	18	121	273	273	0	0	1
MID. ATL.												
New York	28	39	40	[1] 19	[1] 37	[1] 29	175	1,022	826	1	6	6
New Jersey	9	15	16	25	12	15	23	29	95	0	0	2
Pennsylvania	30	36	54				61	131	209	2	9	6
E. NO. CEN.												
Ohio	21	37	37	9		57	23	20	85	2	0	2
Indiana	19	22	29	58	22	44	4	7	34	1	2	2
Illinois	25	43	43	84	60	60	47	45	45	2	1	8
Michigan [2]	12	12	16	6	1	6	465	511	234	0	1	2
Wisconsin	0	1	1	54	52	52	282	378	378	1	0	0
W. NO. CEN.												
Minnesota	0	6	6	2	3	3	206	871	122	0	0	1
Iowa	0	12	9	3	10	10	36	123	40	0	0	0
Missouri	15	14	28	70	24	212	11	13	33	1	1	1
North Dakota	0	4	4	131	12	17	4	261	8	0	0	0
South Dakota	0	6	1	1			0	361	28	0	0	0
Nebraska	1	8	3			1	20	55	27	0	1	0
Kansas	7	14	10	125	9	12	174	5	15	1	0	0
SO. ATL.												
Delaware	0	0	1			1	2	2	8	0	0	0
Maryland [3]	18	9	9	59	12	27	3	665	143	0	2	3
Dist. of Col	0	3	9	9	6	6	7	5	6	0	0	1
Virginia [3, 4]	9	27	27	1,128	282		14	30	188	0	2	2
West Virginia	9	14	17	40	34	56	2	26	26	3	3	4
North Carolina [3]	27	30	29	403	28	35	86	524	524	2	1	1
South Carolina [3]	2	13	5	2,825	865	861	2	8	9	1	3	2
Georgia [3]	13	12	12	1,626	143	284	18	52	0	1	0	3
Florida	8	9	9	59	2	5	7	40	11	0	1	2
E. SO. CEN.												
Kentucky	9	8	20	20	37	54	27	73	73	1	4	7
Tennessee [3]	12	14	20	185	87	200	47	71	32	3	1	3
Alabama [3]	10	13	14	1,085	188	313	42	146	146	1	1	1
Mississippi [3]	13	11	11							1	0	1
W. SO. CEN.												
Arkansas	10	16	15	1,709	145	145	0	17	17	0	0	1
Louisiana [3]	6	16	27	21	12	26	5	85	15	1	0	2
Oklahoma	7	15	15	422	119	191	1	88	7	0	0	3
Texas [3]	42	44	67	1,405	531	531	261	195	195	1	0	3
MOUNTAIN												
Montana	1	0	0		33	33	12	500	7	0	0	0
Idaho	0	0	0		1	2	4	60	50	0	1	0
Wyoming	1	0	0	3			9	21	2	0	0	0
Colorado	9	8	7	73	31		39	64	64	0	1	0
New Mexico	4	1	1	27	21	21	16	49	32	0	9	1
Arizona	5	9	7	230	132	132	9	1	6	0	0	0
Utah [3]	0	0	0	75	2		164	29	16	0	0	0
PACIFIC												
Washington	0	0	1	9	1		521	117	110	0	0	1
Oregon	6	2	2	190	46	56	130	22	22	0	0	0
California	11	36	42	295	82	131	246	1,763	148	3	1	1
Total	415	597	669	12,568	3,097	3,144	3,799	9,284	9,284	29	52	74
3 weeks	1,446	1,888	2,070	34,714	9,370	9,370	11,250	25,811	25,811	87	155	273

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 20, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	Jan. 20, 1940	Jan. 21, 1939		Jan. 20, 1940	Jan. 21, 1939		Jan. 20, 1940	Jan. 21, 1939		Jan. 20, 1940	Jan. 21, 1939	
NEW ENG.												
Maine	0	0	0	3	11	17	0	0	0	0	0	0
New Hampshire	0	0	0	0	16	15	0	0	0	0	0	0
Vermont	0	0	0	3	6	19	0	0	0	0	2	0
Massachusetts	1	0	0	136	195	235	0	0	0	4	1	1
Rhode Island	0	0	0	8	7	25	0	0	0	0	0	0
Connecticut	0	0	0	78	75	68	0	0	0	1	0	1
MID. ATL.												
New York	1	0	1	461	543	692	0	0	0	9	7	6
New Jersey	0	1	0	278	146	146	0	0	0	1	6	2
Pennsylvania	4	0	1	422	500	509	0	0	0	6	7	7
E. NO. CEN.												
Ohio	1	3	2	251	366	366	0	23	3	2	6	5
Indiana	1	0	0	142	228	228	3	104	4	0	2	1
Illinois	0	0	0	449	558	640	1	21	21	6	7	7
Michigan [2]	0	0	0	325	725	574	0	0	0	2	2	2
Wisconsin	0	0	0	137	303	339	12	12	14	0	0	0
W. NO. CEN.												
Minnesota	2	0	0	156	130	141	11	28	28	0	0	0
Iowa	1	0	0	87	140	165	3	42	15	1	1	1
Missouri	0	0	0	75	174	206	0	18	18	3	1	3
North Dakota	0	0	0	10	9	30	0	2	5	2	0	0
South Dakota	0	0	0	14	18	26	2	10	10	0	0	0
Nebraska	0	0	0	27	28	49	0	0	13	0	1	0
Kansas	0	0	0	89	151	198	0	33	26	0	1	2
SO. ATL.												
Delaware	0	0	0	21	7	14	0	0	0	0	0	0
Maryland [3]	0	0	0	40	54	72	0	0	0	1	3	3
Dist. of Col	1	0	0	21	13	18	0	0	0	0	1	2
Virginia [3, 4]	0	2	0	29	22	51	1	0	0	3	6	7
West Virginia	0	0	0	60	60	60	0	1	0	3	9	2
North Carolina [3]	1	0	0	61	58	45	0	0	1	1	2	2
South Carolina [3]	1	2	1	14	12	7	0	0	0	3	2	2
Georgia [3]	0	2	1	40	15	19	0	0	0	1	2	2
Florida	0	0	0	2	12	9	1	0	0	0	0	0
E. SO. CEN.												
Kentucky	1	0	0	76	86	81	0	2	0	0	2	2
Tennessee [3]	0	1	1	97	47	38	0	1	0	2	1	3
Alabama [1]	0	1	1	20	18	18	0	0	1	3	1	2
Mississippi [4]	1	1	0	4	16	10	0	0	1	1	2	1
W. SO. CEN.												
Arkansas	0	1	0	17	9	11	16	5	2	3	3	3
Louisiana [4]	1	0	0	12	21	22	0	0	2	7	6	5
Oklahoma	0	0	0	25	51	51	1	8	1	2	2	2
Texas [1]	4	0	0	93	97	107	1	13	6	15	10	11
MOUNTAIN												
Montana	0	0	0	53	36	36	0	3	12	0	2	0
Idaho	3	0	0	11	38	38	0	9	8	0	2	2
Wyoming	0	0	0	10	6	13	0	1	6	0	0	0
Colorado	2	0	0	46	61	63	15	8	8	2	0	0
New Mexico	0	0	0	14	80	27	0	7	0	0	2	3
Arizona	0	0	0	17	6	24	0	36	0	0	0	0
Utah [3]	0	0	0	23	28	31	0	0	0	0	0	0
PACIFIC												
Washington	0	1	1	78	67	67	0	1	27	0	2	1
Oregon	0	2	1	85	63	50	1	5	5	2	0	0
California	7	1	1	151	221	261	12	20	10	5	5	5
Total	33	18	23	4,220	5,492	6,218	80	413	278	91	109	116
3 weeks	118	50	66	11,960	15,238	17,428	204	1,160	860	250	320	309

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 20, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Whooping cough, week ended— Jan. 20, 1940	Whooping cough, week ended— Jan. 21, 1939	Division and State	Whooping cough, week ended— Jan. 20, 1940	Whooping cough, week ended— Jan. 21, 1939
NEW ENG.			SO. ATL.—continued		
Maine	60	21	North Carolina [3]	45	323
New Hampshire	3	6	South Carolina [3]	9	79
Vermont	40	50	Georgia [3]	20	20
Massachusetts	187	217	Florida	14	15
Rhode Island	12	0	E. SO. CEN.		
Connecticut	72	93	Kentucky	77	4
MID. ATL.			Tennessee [3]	42	35
New York	434	527	Alabama [3]	19	29
New Jersey	123	438	Mississippi [2]		
Pennsylvania	373	636	W. SO. CEN.		
E. NO. CEN.			Arkansas	3	14
Ohio	128	197	Louisiana [3]	2	4
Indiana	86	28	Oklahoma	8	4
Illinois	84	440	Texas [3]	111	87
Michigan [2]	146	383	MOUNTAIN		
Wisconsin	156	320	Montana	5	24
W. NO. CEN.			Idaho	0	5
Minnesota	63	71	Wyoming	24	10
Iowa	2	21	Colorado	8	47
Missouri	15	15	New Mexico	32	41
North Dakota	17	29	Arizona	15	3
South Dakota	0	3	Utah [2]	87	7
Nebraska	1	1	PACIFIC		
Kansas	11	17	Washington	30	28
SO. ATL.			Oregon	32	21
Delaware	3	8	California	163	115
Maryland [2]	86	58			
Dist. of Col	8	32	Total	2,856	4,600
Virginia [3] [4]	43	44			
West Virginia	18	30	3 weeks	7,727	12,963

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Jan. 20, 1940, 20 cases as follows: Virginia, 1; North Carolina, 1; South Carolina, 3; Georgia, 14; Tennessee, 2; Alabama, 6; Louisiana, 2; Texas, 5.
[4] Rocky Mountain spotted fever, week ended Jan. 20, 1940, 1 case, in Virginia.
[5] Diagnosis was changed in 1 case reported as poliomyelitis in Pennsylvania for the week ended Dec. 30, 1939, Public Health Reports of Jan. 5, 1940, p. 32.

WEEKLY REPORTS FROM CITIES

City reports for week ended Jan. 6, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	190	889	126	1,886	974	1,617	32	362	21	1,089	--------
Current week [1]	97	670	61	753	594	924	2	341	12	562	--------
Maine:											
Portland	0	------	0	15	2	0	0	0	0	3	22
New Hampshire:											
Concord	0	------	0	1	0	0	0	0	0	0	4
Manchester	0	------	0	0	1	0	0	0	0	0	16
Nashua	0	------	0	4	0	0	0	0	0	0	4
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	0	10
Rutland	0	------	0	0	1	0	0	0	0	0	5
Massachusetts:											
Boston	0	------	2	17	9	19	0	11	0	35	224
Fall River	1	------	0	0	1	0	0	1	0	9	25
Springfield	0	------	0	0	0	3	0	0	0	4	42
Worcester	0	------	0	0	10	2	0	1	0	1	49
Rhode Island:											
Pawtucket	0	------	0	1	0	0	0	0	0	5	20
Providence	0	------	0	148	7	3	0	2	0	12	79
Connecticut:											
Bridgeport	0	1	1	0	1	3	0	1	0	0	36
Hartford	0	------	0	0	2	2	0	1	0	8	49
New Haven	0	------	0	0	1	2	0	0	0	2	38
New York:											
Buffalo	0	------	0	2	13	9	0	8	0	9	154
New York	14	16	2	11	87	123	0	73	2	53	1,599
Rochester	0	------	0	0	7	6	0	1	0	3	76
Syracuse	0	------	0	0	3	4	0	1	0	16	46
New Jersey:											
Camden	2	------	0	0	7	10	0	1	0	0	40
Newark	0	3	0	1	11	14	0	4	0	20	106
Trenton	0	------	0	0	3	3	0	1	0	0	41
Pennsylvania:											
Philadelphia	3	15	5	2	29	60	0	31	2	32	562
Pittsburgh	0	6	5	0	17	31	0	8	0	4	237
Reading	0	------	0	1	0	0	0	0	0	1	14
Scranton	0	------	------	0	------	6	0	------	0	0	------
Ohio:											
Cincinnati	4	------	2	0	12	22	0	9	0	10	174
Cleveland	0	32	1	4	11	37	0	11	0	35	194
Columbus	4	3	3	1	6	4	0	0	1	1	122
Toledo	0	1	0	6	3	25	0	4	0	5	70
Indiana:											
Anderson	0	------	0	0	0	0	0	0	0	1	16
Fort Wayne	0	0	0	0	3	4	0	1	0	3	27
Indianapolis	0	------	1	1	9	13	0	7	0	8	108
Muncie	0	------	0	0	2	0	0	0	0	0	12
South Bend	0	------	0	0	0	2	0	0	0	0	17
Terre Haute	0	------	0	1	8	1	0	0	0	0	17
Illinois:											
Alton	0	------	0	0	0	3	0	0	0	0	14
Chicago	10	16	0	9	23	178	0	36	0	54	732
Elgin	1	------	0	0	0	1	0	0	0	0	9
Moline	0	------	0	1	0	0	0	0	1	1	9
Springfield	0	------	1	0	2	2	0	0	0	0	22
Michigan:											
Detroit	5	3	1	4	20	65	0	13	0	19	262
Flint	0	------	0	1	6	11	0	2	0	8	34
Grand Rapids	0	------	1	1	8	22	0	0	0	1	38
Wisconsin:											
Kenosha	0	------	0	0	1	1	0	0	0	0	14
Madison	0	1	0	0	1	0	0	0		4	22
Milwaukee	0	------	0	3	11	40	0	3	0	11	111
Racine	0	------	0	0	0	1	0	0	0	0	13
Superior	0	------	0	0	2	2	0	0	0	0	8

[1] Figures for Barre estimated; report not received.

City reports for week ended Jan. 6, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Minnesota:											
Duluth	0		0	91	1	2	0	1	0	0	22
Minneapolis	0		0	0	5	25	0	1	0	4	101
St. Paul	1		0	0	7	13	0	0	0	22	75
Iowa:											
Cedar Rapids	0			9		1	0		0	0	
Davenport	0			0		1	0		0	0	
Des Moines	0		0	15	0	13	0	0	0	0	83
Sioux City	0			0		7	0		0	0	
Waterloo	2			0		3	0		0	0	
Missouri:											
Kansas City	0		1	1	14	10	0	4	0	0	126
St. Joseph	0		0	0	2	1	0	0	0	0	12
St. Louis	2		0	0	15	8	0	5	0	3	209
North Dakota:											
Fargo	0		0	1	0	1	0	0	0	0	9
Grand Forks	0			0		0	0		0	3	
Minot	0		0	0	0	1	0	0	0	0	4
South Dakota:											
Aberdeen	0			0		1	0		0	0	
Sioux Falls	0			0	0	1	0	0	0	0	9
Nebraska:											
Lincoln	0			0		1	0		0	0	
Omaha	2		0	0	11	2	0	0	0	4	75
Kansas:											
Lawrence	0	3	0	0	1	0	0	0	0	0	8
Topeka	0	1	1	0	4	8	0	0	0	1	29
Wichita	4	6	1	90	2	4	0	0	0	0	25
Delaware:											
Wilmington	0		0	0	5	3	0	1	0	3	31
Maryland:											
Baltimore	3	13	4	0	15	8	0	14	0	39	251
Cumberland	0		0	0	0	0	0	0	0	0	11
Frederick	2		0	0	0	1	0	0	0	0	2
Dist. of Col.:											
Washington	3	1	1	1	13	11	0	13	1	7	191
Virginia:											
Lynchburg	0		0	0	2	1	0	0	0	11	10
Norfolk	0	8	0	0	2	5	0	0	0	0	28
Richmond	0		0	6	8	8	0	1	0	0	65
Roanoke	1		0	0	0	2	0	0	0	0	12
West Virginia:											
Charleston	1	3	0	0	4	1	0	0	1	0	32
Huntington	2			0		1	0		0	0	
Wheeling	0		0	0	2	3	0	2	0	2	20
North Carolina:											
Gastonia	0	1		0		0	0		0	0	
Raleigh	0		0	0	5	0	0	0	0	0	21
Wilmington	1		0	0	1	0	0	0	0	0	15
Winston-Salem	0		0	0	2	5	0	2	0	0	13
South Carolina:											
Charleston	1	281	0	0	3	0	0	0	0	0	20
Florence	4	47	1	0	3	1	0	0	0	0	11
Greenville	0		0	0	8	0	0	1	0	0	52
Georgia:											
Atlanta	1	134	2	12	5	7	0	9	0	1	90
Brunswick	0		0	0	1	1	0	0	0	1	3
Savannah	0	86	5	0	6	5	0	1	0	0	49
Florida:											
Miami	0	3	1	0	2	2	0	1	1	0	40
Tampa	1		0	0	1	0	0	0	0	1	24
Kentucky:											
Ashland	0	1	0	0	1	0	0	0	0	3	6
Covington	0		0	2	1	1	0	0	0	0	19
Lexington	0		0	0	2	1	0	1	0	1	18
Louisville	0		0	0	12	0	0	3	0	0	88
Tennessee:											
Knoxville	0		0	0	5	7	0	1	0	0	28
Memphis	1		2	1	9	5	0	1	0	6	100
Nashville	1		0	10	2	0	0	3	0	1	43
Alabama:											
Birmingham	3	5	2	1	5	4	0	4	0	1	95
Mobile	0		0	0	5	0	2	0	0	0	31
Montgomery	2	26		9		0	0		0	0	

City reports for week ended Jan. 6, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Arkansas:											
Fort Smith	0	2		0		0	0		0	0	
Little Rock	2	2	1	0	4	3	0	0	0	0	25
Louisiana:											
Lake Charles	0		0	0	4	1	0	0	0	0	8
New Orleans	7	3	3	1	20	8	0	9	0	0	225
Shreveport	0		0	0	7	1	0	0	0	0	48
Oklahoma:											
Oklahoma City	0		0	0	3	2	0	2	1	2	52
Tulsa	0			0		1	0		0	1	
Texas:											
Dallas	5		2	1	4	4	0	4	0	0	71
Fort Worth	0		0	0	1	2	0	1	0	5	44
Galveston	0		0	0	3	1	0	1	0	0	21
Houston	0		0	0	8	4	0	5	1	1	96
San Antonio	1	6	1	60	7	1	0	8	0	0	75
Montana:											
Billings	0		0	0	2	2	0	0	0	0	9
Great Falls	0		0	2	1	0	0	1	0	0	10
Helena	0		0	1	0	0	0	0	0	0	5
Missoula	0		0	0	2	0	0	0	0	2	7
Idaho:											
Boise	0		0	0	0	0	0	0	0	0	7
Colorado:											
Colorado Springs	0		0	0	3	0	0	0	0	0	17
Denver	2		3	1	12	4	0	6	0	14	115
Pueblo	0		0	0	0	0	0	0	1	0	9
New Mexico:											
Albuquerque	0		0	0	2	0	0	0	0	1	8
Utah:											
Salt Lake City	0		2	32	2	2	0	1	0	30	55
Washington:											
Seattle	0		0	28	2	7	0	2	0	13	62
Spokane	0		0	0	1	6	0	0	0	0	26
Tacoma	0		0	184	3	8	0	0	0	0	27
Oregon:											
Portland	1	8	0	20	1	7	0	2	0	6	85
Salem	0	2		4		1	0		0	0	
California:											
Los Angeles	7	30	4	8	14	21	0	8	0	18	330
Sacramento	1		0	0	3	1	0	1	0	2	28
San Francisco	1	3	1	8	13	5	0	6	0	10	168

State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Poliomyelitis cases
New York:			
New York	1	0	0
Rochester	0	0	1
Illinois:			
Alton	1	1	0
Chicago	1	0	0
Michigan:			
Detroit	0	0	1
Minnesota:			
St. Paul	0	0	1
Iowa:			
Des Moines	0	0	1
Missouri:			
St. Joseph	1	0	0
District of Columbia:			
Washington	0	0	2
North Carolina:			
Wilmington	1	1	0
Florida:			
Miami	1	0	0
Louisiana:			
Shreveport	0	2	0
Texas:			
Galveston	0	0	1
Utah:			
Salt Lake City	0	0	1
California:			
Sacramento	0	0	1
San Francisco	1	0	0

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Denver, 1.
Pellagra.—Cases: Boston, 1; Baltimore, 1; Florence, 1; Atlanta, 1; Savannah, 1; Birmingham, 1; Montgomery, 4.
Typhus fever.—Cases: New York, 1; Baltimore, 1; New Orleans, 1.

FOREIGN REPORTS

BRAZIL

Rio de Janeiro—Poliomyelitis.—According to a report dated January 5, 1940, poliomyelitis has been reported in Rio de Janeiro, Brazil, as follows:

Week ended—	*Cases*	*Deaths*	Week ended—	*Cases*	*Deaths*
November 4, 1939	22	2	December 2, 1939	3	2
November 11, 1939	12	3	December 9, 1939	3	2
November 18, 1939	17	--	December 16, 1939	5	--
November 25, 1939	11	1	December 23, 1939	2	--

CANADA

Provinces—Communicable diseases—Week ended December 16, 1939.—During the week ended December 16, 1939, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox		34	7	234	529	62	20	34	87	1,016
Diphtheria				11	3	11	7			32
Influenza		44			19				6	69
Lethargic encephalitis				2						2
Measles		5	1	57	311	20	3	6	10	413
Mumps				39	163	13	10		4	229
Pneumonia		14			20		1		5	40
Poliomyelitis				1						1
Scarlet fever	28	11	33	102	136	24	11	39	18	402
Tuberculosis	2	3	22	71	42					140
Typhoid and paratyphoid fever		2		14	3	1	1			21
Whooping cough		17	1	173	127	31	52	24	9	434

CUBA

Provinces—Notifiable diseases—4 weeks ended November 11, 1939.—During the 4 weeks ended November 11, 1939, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	2	3	1	5		4	15
Chickenpox						1	1
Diphtheria		20		2	1	1	24
Hookworm disease		101		1			102
Leprosy		1		3	1	1	6
Malaria	41	31		13	2	53	140
Measles						7	7
Poliomyelitis	4	6		1			11
Tetanus, infantile			1				1
Trachoma				1			1
Tuberculosis	22	42	31	37	14	22	168
Typhoid fever	18	48	8	38	10	36	158

IRISH FREE STATE

Vital statistics—Quarter ended September 30, 1939.—The following vital statistics for the Irish Free State for the quarter ended September 30, 1939, are taken from the Quarterly Return of Marriages, Births, and Deaths, issued by the Registrar General and are provisional:

	Number	Rate per 1,000 population		Number	Rate per 1,000 population
Marriages	4, 505	6. 1	Deaths from—Continued.		
Births	14, 204	19. 4	Influenza	62	0 1
Total deaths	8, 600	11. 7	Measles	11	
Deaths under 1 year of age	744	[1] 52	Puerperal sepsis	9	[1] . 6
Deaths from:			Scarlet fever	8	
Cancer	893	1. 2	Tuberculosis (all forms)	759	1. 0
Diarrhea and enteritis (under 2 years)	161		Typhoid fever	14	
Diphtheria	38		Typhus fever	3	
			Whooping cough	27	

[1] Per 1,000 live births.

SCOTLAND

Vital statistics—Third quarter 1939.—Following are vital statistics for Scotland for the third quarter of 1939:

	Number	Rate per 1,000 population		Number	Rate per 1,000 population
Marriages	15, 617	12. 4	Deaths from—Continued.		
Births	21, 546	17. 1	Lethargic encephalitis	22	
Deaths	13, 587	10. 8	Malaria	2	
Deaths under 1 year of age	1, 220	[1] 57	Measles	5	
Deaths from:			Nephritis, acute and chronic	348	
Appendicitis	91		Pneumonia (all forms)	425	. 34
Cancer	1, 913	1. 51	Poliomyelitis	1	
Cerebral hemorrhage	1, 518		Puerperal sepsis	15	
Cerebrospinal fever	7		Scarlet fever	9	
Cirrhosis of the liver	33		Senility	489	
Diabetes mellitus	172		Suicide	125	
Diarrhea and enteritis (under 2 years)	249		Syphilis	15	
Diphtheria	77		Tuberculosis (all forms)	782	. 62
Dysentery	8		Typhoid fever	9	
Heart disease	3, 269		Whooping cough	39	
Influenza	24				

[1] Per 1,000 live births.

VIRGIN ISLANDS

Notifiable diseases—October–December 1939.—During the months of October, November, and December 1939, cases of certain notifiable diseases were reported in the Virgin Islands as follows:

Disease	October	November	December	Disease	October	November	December
Chickenpox		1		Pneumonia	2		
Filariasis	4	2	6	Schistosomiasis	2	1	
Gonorrhea	11	8	8	Sprue	1		
Hookworm disease	4	6	6	Syphilis	61	21	30
Malaria		1		Tuberculosis	1		2

YUGOSLAVIA

Communicable diseases—4 weeks ended December 3, 1939.—During the 4 weeks ended December 3, 1939, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	32	3	Paratyphoid fever	21	
Cerebrospinal meningitis	31	12	Poliomyelitis	5	
Diphtheria and croup	1,123	110	Scarlet fever	516	2
Dysentery	36	10	Sepsis	5	2
Erysipelas	231	10	Tetanus	28	15
Favus	11		Typhoid fever	491	48
Leprosy	2		Typhus fever	13	
Lethargic encephalitis	16		Weil's disease	1	

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From the medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following table must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place		Jan. 1-Oct. 31, 1939	November 1939	December 1939—Week ended— 2	9	16	23	30
ASIA								
Afghanistan	D	578						
Ceylon: **Batticaloa**	C	7						
China	C	2,637	68					
Canton	C	9						
Hong Kong	C	672	12				3	1
Shanghai	C	421	6					
Tientsin	C	1	33					
India	C	106,729	6,001					
Bassein	C	14						
Calcutta	C	3,734	69	18	25	33	28	20
Madras	C	6						
Negapatam	C	2						
Rangoon	C	17						1
India (French)	C	89	1					
India (Portuguese)	C	17						
Indochina (French)	C	1						
Iran	C	435						
Iraq: **Basra**	C	[1] 1						
Japan: **Osaka**	C	[2] 1						
Thailand	C	25						
Bangkok	C	7						

[1] Suspected.
[2] Imported.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE

[C indicates cases; D, deaths]

Place		Jan. 1–Oct. 31, 1939	November 1939	December 1939—Week ended—				
				2	9	16	23	30
AFRICA								
Algeria: Algiers	C	1						
Belgian Congo	C	52	2	1	1	1		1
British East Africa:								
Kenya	C	4						
Nyasaland	C	2						
Uganda	C	282	11					
Egypt: Asyut Province	C	102						
Madagascar	C	429						
Tunisia: Tunis	C	1						
Plague-infected rats		5						
Union of South Africa	C	67	6	4				
ASIA								
China:								
Fukien Province	D	[1]753						
Manchuria	D	332						
Dutch East Indies:								
Java:								
Batavia	C	[3]1						
Batavia Residency	D	[3]84						
Java and Madura	C	1,411						
India	C	30,405						
Bassein	C	12						
Calcutta	C	[2]1			[2]1			
Cochin	C		1			1	1	
Plague-infected rats						2	1	
Rangoon	C	7	[2]1					
Indochina (French)	C	2						
Thailand:								
Bichitr Province	C	4						
Bisnulok Province	C	35						
Kamphaeng Bajr Province	C							6
Lampang Province	C	1						
Prae Province	C	6						
Svargalok Province	C	30						
Tak Province	C	10						
SOUTH AMERICA								
Argentina:								
Jujuy Province	C	1						
Mendoza Province	C	1						
Salta Province	C	1						
San Luis Province	C	1						
Tucuman Province	C	1						
Bolivia	C	[3]2						
Brazil:								
Alagoas State	C	43						
Bahia State	C	1						
Parahiba State	C	1						
Pernambuco State	C	32						
Sao Paulo State	C	1						
Ecuador:								
Chimborazo Province	C	24						
Riobamba	C	[3]16						
Guayaquil	C	3						
Plague-infected rats		45						
Loja	C	4						
Puebla Viejo	C	3						
Peru:								
Cajamarca Department	C	3						
Lambayeque Department	C	5						
Libertad Department	C	25						
Lima Department	C	17						
Piura Department	C	26						
Venezuela [4]	C				3			
OCEANIA								
Hawaii Territory:								
Paauhau	C							[3]1
Plague-infected rats		42	5		2	3	2	

[1] Includes 94 deaths from pneumonic plague.
[2] Imported.
[3] Pneumonic.
[4] For the period December 7, 1939, to January 4, 1940, there have been reported 11 cases of plague with 8 deaths in Venezuela.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX

[C indicates cases; D, death.]

Place		Jan. 1-Oct. 31, 1939	November 1939	December 1939 - Week ended— 2	9	16	23	30
AFRICA								
Algeria	C	6						
Angola	C	104						
Belgian Congo	C	1,807	141	70	78			
British East Africa	C	664	1					
Dahomey	C	39	12		15			
Eritrea	C	2						
French Equatorial Africa	C	45						
French Guinea	C	40						
Gold Coast	C	141						
Ivory Coast	C	239	69					
Morocco	C	10						
Mozambique	C	66	13					
Nigeria	C	4,335	40					
Niger Territory	C	134						
Portuguese East Africa	C	10						
Portuguese Guinea	C	122						
Rhodesia:								
Northern	C	9	11					
Southern	C	131	6					
Senegal	C	256						
Sierra Leone	C	50						
Sudan (Anglo-Egyptian)	C	327	89	57	34		45	
Sudan (French)	C	27						
Union of South Africa	C	144						
ASIA								
Arabia	C	1						
Ceylon	C	1						
China	C	1,565	4	3	3	8		
Chosen	C	90						
India	C	99,638	1,236					
India (French)	C	54						
Indochina (French)	C	3,470	42					
Iran	C	46	20					
Iraq	C	20	31		7	10	21	2
Japan	C	228						
Straits Settlements	C	1						
Syria	C	1						
Thailand	C	155						
EUROPE								
France	C	4						
Great Britain	C	1						
Greece	C	69						
Portugal	C	834	13					
Spain	C	192	255					
Canary Islands	C	3						
Turkey	C	367						
NORTH AMERICA								
Canada	C	156			4			
Guatemala	C	9						
Mexico	D	1,264						
Salvador	C	1						
SOUTH AMERICA								
Argentina	C	3						
Bolivia	C	187						
Brazil	C	13						
Colombia	C	2,571	13	3	5			
Ecuador	C	8						
Uruguay	C	5						
Venezuela	C	84	16			1		

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER

[C indicates cases; D, deaths]

Place		Jan. 1–Oct. 31, 1939	November 1939	December 1939—Week ended— 2	9	16	23	30
AFRICA								
Algeria	C	1,806	31	4				
British East Africa	C	2						
Egypt	C	3,991	6	5	15	17	39	
Eritrea	C	9						
Libya	C	37			[illegible]	[illegible]		
Morocco	C	894	3	[illegible]	4	[illegible]		
Nigeria	C	1	[illegible]	[illegible]	[illegible]	[illegible]		
Portuguese East Africa	C	2		[illegible]	[illegible]	[illegible]		
Southern Rhodesia	C		3					
Swaziland	C	1						
Tunisia	C	6,002	19	10	[illegible]	33		
Union of South Africa	C	785	21					
ASIA								
China	C	199	23	[illegible]	[illegible]	[illegible]		
Chosen	C	729		[illegible]		[illegible]		
India	C	17		[illegible]		[illegible]		
Iran	C	66	2	[illegible]				
Iraq	C	46	[illegible]	[illegible]	[illegible]			
Palestine	C	98	21	[illegible]	2	2	8	4
Straits Settlements	C	12	[illegible]					
Sumatra	C	[illegible]						
Syria	C	5						
Trans-Jordan	C	18	1					
EUROPE								
Bulgaria	C	50						
Greece	C	13						
Hungary	C	23						
Irish Free State	C	5						
Latvia	C	3						
Lithuania	C	149						
Poland	C	3,140						
Portugal	C	15	1					
Rumania	C	716	95		25	37		26
Spain	C	42	12					
Turkey	C	347	3					
Yugoslavia	C	367	9	7				
NORTH AMERICA								
Cuba	C					[1] 1		
Guatemala	C	161	29					
Mexico	D	331	8					
Panama Canal Zone	C	3						
SOUTH AMERICA								
Bolivia	C	93	19	5	1			
Chile	C	1,119						
Peru	C	107						
Venezuela	C	9	1					
OCEANIA								
Australia	C	20						
Hawaii Territory	C	28	2		2	2		

[1] Exact date not given.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

YELLOW FEVER

[C indicates cases; D, deaths]

Place		Jan. 1-Oct 31, 1939	November 1939	December 1939—Week ended—				
				2	9	16	23	30
AFRICA								
Cameroon: Bafia	C	1						
French Equatorial Africa:								
Bangui	C	[1] 1						
Chad—Fort Lamy	C	1						
Gabon	D	1						
French Guinea	C	2						
Gold Coast	C	2						
Ivory Coast	C	[2] 22	1	[1] 1				
Nigeria	C	[4] 7	3			1		
Niger Territory:								
Dosso	C		3					
Konni Circle	C	3						
Tahua	C	1						
Senegal:								
Bambey	C	1						
Dakar	C		[1] 1					
Diourbel	C	6						
Louga	C				[1] 1			
Ziguinchor	C	10						
Sudan (French): Bandiagara	C	1						
Togo (French): Anecho	C	1						
SOUTH AMERICA								
Brazil:								
Amazonas State	D	[5] 1						
Bahia State	D	[5] 1						
Espirito Santo State	D	96				[5] 3	[5] 3	
Minas Geraes State	D	13						
Para State	D	3						
Rio de Janeiro State	D	3						
Colombia: Antioquia Department—								
Caracoli	D	2						
San Carlos	D	5						

[1] Suspected.
[2] During the week ended Jan. 6, 1940, 1 fatal case of yellow fever was reported in Sankadiokro, Ivory Coast.
[3] Includes 7 suspected cases.
[4] Includes 3 suspected cases.
[5] Jungle type.

X

Public Health Reports

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IN THIS ISSUE

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UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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Public Health Reports

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COMMUNITY ECONOMIC STATUS AND THE DENTAL PROBLEM OF SCHOOL CHILDREN [1]

By HENRY KLEIN, *Dental Officer*, and CARROLL E. PALMER, *Passed Assistant Surgeon, United States Public Health Service*

INTRODUCTION

Factors described broadly by the term "socio-economic" affect to a marked extent the public health approach to many diseases. The application of findings derived from a study of these factors in the diarrheal conditions of infancy, in tuberculosis, hookworm, and other conditions has contributed significantly to the design of practical programs directed towards the reduction of morbidity and mortality from these diseases. In the light of these considerations further delineation of the importance of the socio-economic variables in the oral pathologies is clearly justified.

The present paper is concerned with a preliminary study of the influence of *community* socio-economic condition on the incidence of dental caries, the receipt of dental care, tooth loss, and other measurable aspects of the dental problem among children in the community. The findings are based on dental examinations of nearly a quarter of a million white elementary school children, all living within the relatively narrow geographic confines of the State of New Jersey and in communities which are widely differentiated with respect to economic status.

The analysis appears to show that the economic status of these communities bears little relationship to the tendency of the children to experience attack by caries in the permanent teeth. On the other hand, the study clearly reveals that intimate relationships exist between economic status, the volume of dental care dispensed, and the total number of permanent teeth extracted and indicated for extraction. The implications of these findings are discussed. The facts at hand lead to the conclusion that the number of permanent teeth extracted and indicated for extraction, although supplying a rough measure of the level of dental care dispensed, cannot be viewed in the light of present knowledge as a precise measure of the efficacy or volume of dental care.

[1] From the Division of Public Health Methods, National Institute of Health. Presented at the meeting of the American Public Health Association, October 20, 1939.

MATERIAL AND METHODS

Most of the basic data for the present analysis were derived from a recent Public Health Bulletin (*1*) which reported the results of a Nation-wide dental survey conducted by the American Dental Association and the United States Public Health Service. Among other items, the Bulletin contains tabulations of the following four observations[2] on the permanent teeth of children of each of 40 urban communities of New Jersey: (1) The number of carious defects; (2) the number of filled teeth; (3) the number of extracted teeth; and (4) the number of teeth for which extraction was indicated.

In the published tabulations these basic observations are expressed as rates, that is, the number per 100 children, and separate listings are given for boys and girls and for the three age groups, 6–8, 9–11, and 12–14. In addition to these four descriptive items, two others were obtained for the present study by making certain combinations of these basic tabulations. The first of these additional items, obtained by adding the rates for extracted permanent teeth and extractions indicated, was calculated for the purpose of obtaining community-specific tooth mortality or "odontothanatotic" rates.[3]

The second derived value was obtained by adding all four of the original rates; that is, the number of carious defects, the number of filled teeth, the number of extracted teeth, and the number of extractions indicated. The value resulting from this summation, here designated *d*MF, was derived in order to approach a reconstitution of the caries experience in the permanent teeth of the children.[4]

It is necessary to consider briefly several general and specific limitations of these data. In this connection it is desirable to note that the observations made in New Jersey were recorded by a number of

[2] The observations are designated specifically in the Bulletin as follows: (1) Caries, permanent teeth, number per 100 children; (2) filled permanent teeth, number per 100 children; (3) extracted permanent teeth, number per 100 children; (4) extractions indicated, permanent teeth, number per 100 children.

[3] In order to afford a term for designating teeth extracted and those indicated for extraction, Wisan ([illegible]) has suggested "lost permanent teeth." Since the word "lost" would convey the meaning of absence from the mouth, this term seems somewhat less inclusive of the meaning desired than others which may be developed. Since teeth already extracted and those requiring extraction are made up almost entirely by teeth which have died, the expression "tooth mortality" would at first glance appear suitable (*3*). However, this latter term has been interpreted as referring to deaths of persons from dental pathology. This is understandable since the word "mortality," through long usage in demographic studies, has come to mean almost exclusively deaths of persons. These considerations and the relative importance of extractions and indicated extractions in the dental problem of children would seem to call for the introduction of a te [illegible] convey clearly the meaning intended. It is suggested, therefore, that the word "odontothanatosis" from the Greek "odonto" (tooth) and "thanatos" (execution or death) serve as the definitive term to designate teeth extracted and indicated for extraction.

[4] The total number of permanent teeth observed to be affected by past and present caries at a particular examination is constituted by accumulations of all the caries episodes which occurred each year from the time of eruption of the permanent teeth until the time of examination. Counts of the number of permanent teeth with active caries, with fillings, plus those extracted from the mouth or indicated for extraction presumably because of caries, provide information which defines in substance the involvement of a particular mouth or group of mouths by past and present caries attack. Such counts of caries experience make available a rough quantitative measure of the intrinsic tendency of a particular person or a group of persons to experience attack by dental caries.

different dentists. Accordingly, variations in interpretations among the examiners undoubtedly existed. The item most markedly influenced probably is the count of the number of carious defects in the permanent teeth, since it is known that some of the examiners included pits and fissures presumptively as caries while others did not do so.[5] Observations on the number of filled and extracted permanent teeth are probably only slightly affected by variations arising from subjective interpretation. On the other hand, subjective decisions very likely entered into the recording of permanent teeth for which extraction was indicated (*4*).

Particular consideration should be given to the value designated as the *d*MF rate. As shown in previous communications (*5*, *6*, *7*) and elsewhere (*8*, *9*, *10*), a reconstitution of the caries experience in the permanent teeth of children may be accomplished with a fair degree of precision by totaling the *mutually exclusive* numbers of carious teeth (irrespective of the number of defects per tooth), the number of filled teeth, and the number of extracted teeth plus those indicated for extraction. The summation of these values gives a count of the number of permanent teeth showing evidence of having been attacked by caries; in previous communications this has been called the count of DMF teeth (the decayed, missing, and filled permanent teeth). In the material available for the present study the M (missing teeth plus those indicated for extraction) and F (filled teeth) portions of the DMF count can be obtained readily by adding together the mutually exclusive items, extracted teeth plus indicated extractions, and filled teeth. However, the D portion of the count, that is, the number of permanent teeth affected by one or more unfilled carious defects, is not available in the tabulations provided in the Bulletin.[6] It was necessary, therefore, to use instead the counts of carious defects which are provided. As a result a "modified caries experience" or "*d*MF" rate is obtained. Obviously caution is necessary in the use of this rate, but it would appear reasonable to assume that the *d*MF values approximately parallel the actual caries experience (DMF) rates of the children in the communities studied.

The socio-economic status of the urban communities of New Jersey is expressed as the percentage of rented nonfarm homes renting for \$50 or more per month. These index values, derived from information given in publications of the Bureau of the Census (*11*), ranged fairly uniformly from a minimum of 2 to a maximum of just over 70 percent.

---

[5] Subsequent to the collection of the original data, questionnaires were sent out to the 12 dentists who made the examinations in New Jersey. Nine returned answers to the following specific inquiry: "In addition to objective signs of caries were pits and fissures counted as caries? Yes ..... No ... " Six reported in the affirmative and three in the negative. See p. 4 of reference (*1*).

[6] Teeth with evidence of caries experience have been designated by various terms. Salzmann (*8*) has the expression "ex-teeth" and Hollander and Dunning (*9*) have used "affected teeth."

The survey, on which Bulletin No. 226 was based, was designed, primarily, with the thought of dental needs in mind. Thus the number of carious defects was set down instead of the number of carious teeth

In general the communities with high economic indices are affluent residential areas within commuting distance of large metropolitan districts. Many of the communities with low indices are highly industrialized, relatively impoverished, suburban areas adjacent to larger urban centers. Communities having indices in the middle range are in most instances either the larger urban centers or political subdivisions contiguous to these centers. It is clear that the index (the percentage of rented nonfarm homes renting for $50 or more per month) represents an approximate and restricted measure of those complex factors which all together may be taken to constitute socio-economic status. On the other hand, additional knowledge of the New Jersey communities supports the view that this index does serve satisfactorily for present purposes to differentiate the communities in respect to socio-economic condition.

The communities studied (designated by number), the economic indices, and detailed tabulations on the dental conditions of the children are given in the appendix, table 1A.

In order to study the relationship between the economic variable and the dental status of children it has seemed satisfactory to express the character of the relationship primarily in terms of correlation coefficients (Pearsonian r). It is recognized that for the material at hand such coefficients will show only in broad and summary form the consequences of the interplay of a variety of influences. Some of these are apparent; others, though doubtlessly participating in the interplay of factors, are not immediately discernible. That the dental status of the children of these localities may be related to variables other than those identified here is not excluded by the present analysis.

FINDINGS

Community economic status and caries experience. Correlation coefficients showing the relationship between the index of economic status and the level of caries experience (*d*MF rates) are given in table 1. In order to illustrate other characteristics of the relationship,

TABLE 1. *Correlation coefficients and their respective standard deviations for the relationship between community economic status and intensity of attack by caries* (*d*MF). *Data derived from observations in 40 urban communities of New Jersey*

Sex	Age group (years)		
	6–8	9–11	12–14
Boys	-0.31 ± 0.16	0.03 ± 0.16	0.15 ± 0.16
Girls	-0.28 ± 0.16	0.11 ± 0.16	0.03 ± 0.16

figure 1 presents the data for girls in the form of three scatter diagrams, one for each age group. This figure also shows the results of fitting straight lines to the data for each age group of children (a similar

diagram for the boys shows essentially the same relationship and is not reproduced here). Although wide fluctuations in the caries experience rates are apparent from community to community, they do not occur systematically with changes in the economic index. As

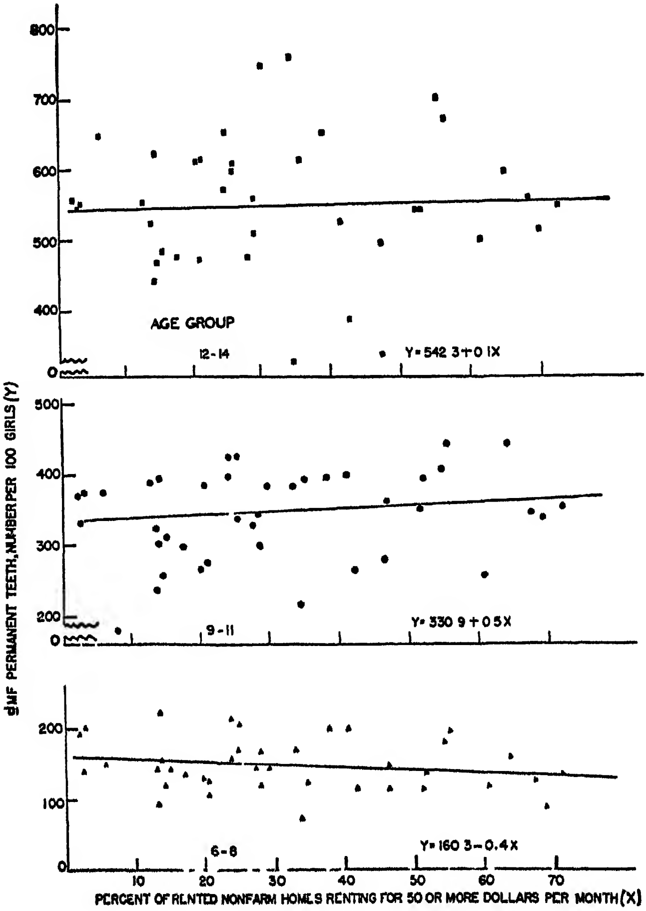

FIGURE 1. Scatter diagrams and fitted lines illustrating the relationship between community economic status and intensity of attack by caries (dMF), for girls 6–8, 9–11, and 12–14 years old. Data derived from observations in 40 urban communities of New Jersey.

may be noted in table 1, the coefficients in general are small, their signs are not consistent for all age groups, and none is statistically significant. Although these findings are based on caries experience rates which are affected by the limitations previously discussed, the analysis appears to show that the tendency of children to experience attack by caries in the permanent teeth (the intensity of attack by caries) is not selective for children living in communities which differ

markedly in economic status.[7] The findings of Cohen (*12*), Greenwald (*13*), Franzen (*14*), and Miller and Crombie (*15*) support this impression.

Community economic status and filled permanent teeth.—The relationship between the number of filled permanent teeth per 100 children and the percentage of rented nonfarm homes renting for $50

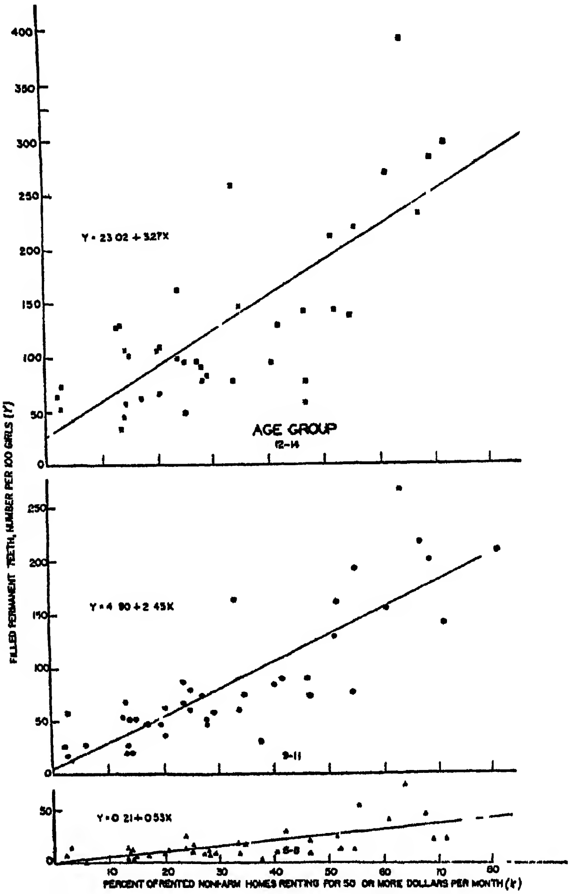

FIGURE 2.—Scatter diagrams and fitted lines illustrating the relationship between community economic status and dental care (filled permanent teeth), for girls 6-8, 9-11, and 12-14 years old. Data derived from observations in 40 urban communities of New Jersey.

or more per month is shown graphically in figure 2 for the girls and the correlation coefficients for these variables are given in table 2 for both sexes. From the spot diagram showing the data for girls and from the coefficients given in table 2, it is evident that the number of

[7] Data available from studies as yet unpublished support the view that secondary *extensions* of caries are considerably reduced in children receiving remedial dental care, that is, in those who may be in better economic circumstances. It should be emphasized that the question under discussion above refers primarily to intrinsic or initial caries experience. This subject of inquiry is clearly distinct from that concerned with secondary extensions of the carious process.

filled teeth is highly correlated with the indices of economic status. All of the coefficients are positive, all are greater than 0.6, and all are statistically significant. In addition to the fact that the coefficients are uniformly high, there is apparent a marked increase in the number of filled teeth with increase in the indices of economic status. For example, in the localities having very low economic indices each 100 girls between the ages of 12 and 14 years have of the order of 50 filled permanent teeth. On the other hand, the number of filled teeth per 100 girls of the same age grouping in the areas having very high economic indices is nearly five times greater. In some respects a consistent and marked relationship between the filled tooth rate and the indices of economic status may appear to constitute an obvious finding.

TABLE 2.—*Correlation coefficients and their respective standard deviations for the relationship between community economic status and dental care (filled permanent teeth). Data derived from observations in 40 urban communities of New Jersey*

Sex	Age group (years)		
	6–8	9–11	12–14
Boys	0.63±0.10	0.79±0.06	0.77±0.07
Girls	0.66±0.09	0.81±0.06	0.75±0.07

As such, however, it lends support to the impression that the indices of community economic status used in the present study actually serve to differentiate the several urban areas with respect to ability to utilize available professional dental services. That the economic status of the family affects the variety and volume of dental care received is shown by the investigations of Collins (*16*), Klem (*17*), and Britten (*18*).

Community economic status and indicated extractions.—Table 3 gives the correlation coefficients for the community indices of economic status and the rates expressing the number of permanent teeth remaining in the mouth but for which extraction is indicated. For the younger children, as may be expected, the coefficients are relatively low. For the older age groups, however, it is evident that a high inverse association exists between the two variables under discussion.

TABLE 3.—*Correlation coefficients and their respective standard deviations for the relationship between community economic status and indicated extractions of permanent teeth. Data derived from observations in 40 urban communities of New Jersey*

Sex	Age group (years)		
	6–8	9–11	12–14
Boys	−0.31±0.14	−0.71±0.08	−0.67±0.09
Girls	−0.50±0.12	−0.67±0.09	−0.65±0.09

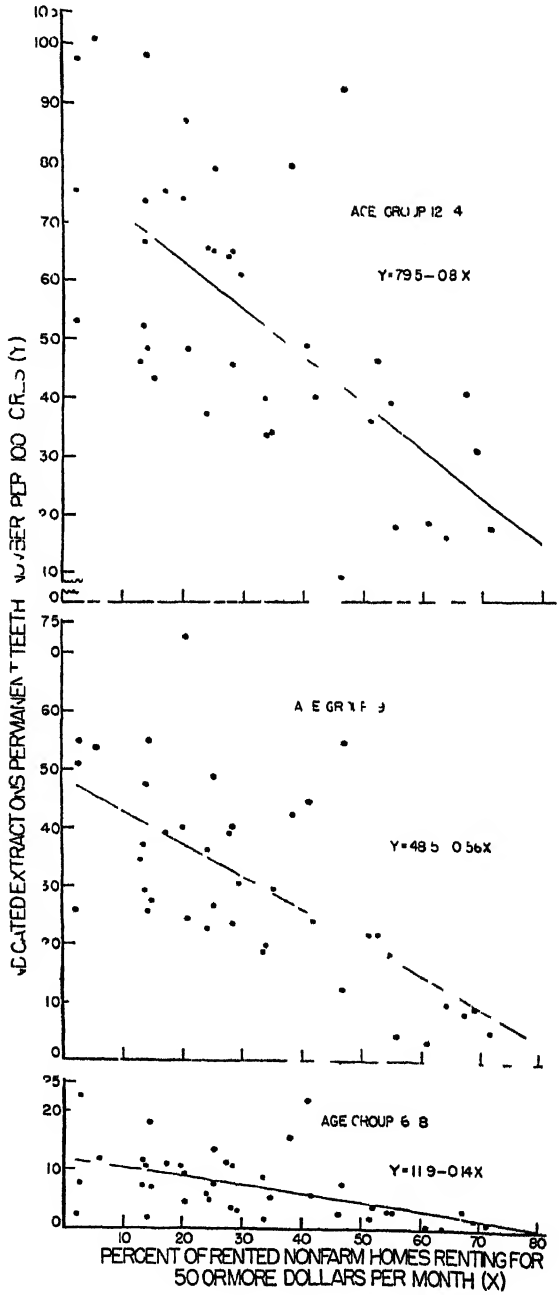

FIGURE 3.—Scatter diagrams and fitted lines illustrating the relationship between community …omic status and indicated extractions of permanent teeth for girls … 11 and … 14 years old. Data derived from observations in 10 urban communities of New Jersey.

Inspection of the data given in the appendix, table 1A, and presented graphically in figure 3 shows that in communities having very low economic status girls 12–14 years of age have approximately 75 indicated extractions per 100 individuals, while each 100 girls of the same age living in communities having high indices need less than 20 extractions. A similar relationship obtains for boys. Clearly the presence of 75 severely decayed or nonvital permanent teeth for each 100 girls 12–14 years of age must represent a considerable health hazard. The findings presented would indicate that community economic status is intimately and inversely associated with the extent of this problem.[8]

Community economic status and extracted permanent teeth.—The extraction of permanent teeth in children, since this is usually accomplished by the dentist, constitutes a form of dental service which may have an important relationship to the economic status of a community. Table 4, giving the correlation coefficients for these two

TABLE 4.—*Correlation coefficients and their respective standard deviations for the relationship between community economic status and extracted permanent teeth. Data derived from observations in 40 urban communities of New Jersey*

	Age group (years)		
	6–8	9–11	12–14
Boys	−0.25±0.16	−0.18±0.16	−0.21±0.15
Girls	−0.37±0.15	−0.37±0.14	−0.41±0.13

variables, suggests that there is a low inverse association between the number of extracted permanent teeth in the children examined and community economic level. Although the evidence which bears directly on this point is not entirely conclusive (the coefficients are low and not statistically significant in every case), it is of considerable interest to note that the general character of the relationship between economic status and this type of dental service is different from the relationship between economic status and dental service in the form of fillings. Thus, with increase in the economic level of the communities there occurs a striking *increase* in the number of permanent teeth filled and a concomitant slight *decrease* in the number of permanent teeth extracted. The finding of a slight decrease in the extracted tooth rate with increase in the value of the economic indices must be integrated with the observation that a large residuum of

[8] It is necessary to recognize that a part of the wide differences in the rates for indicated extraction observed between the areas of high and low economic status may be the result of differences in criteria as to when an extraction is indicated. Thus, a badly decayed tooth in a poorer community might be indicated for extraction, while in a more affluent community the same tooth might be considered as indicated for filling since the greater cost of placing a filling may be more readily undertaken in the more prosperous area.

indicated extractions exists in the mouths of the children of the poorer communities. When the teeth which should be extracted are added to the extractions already accomplished it may be seen, as

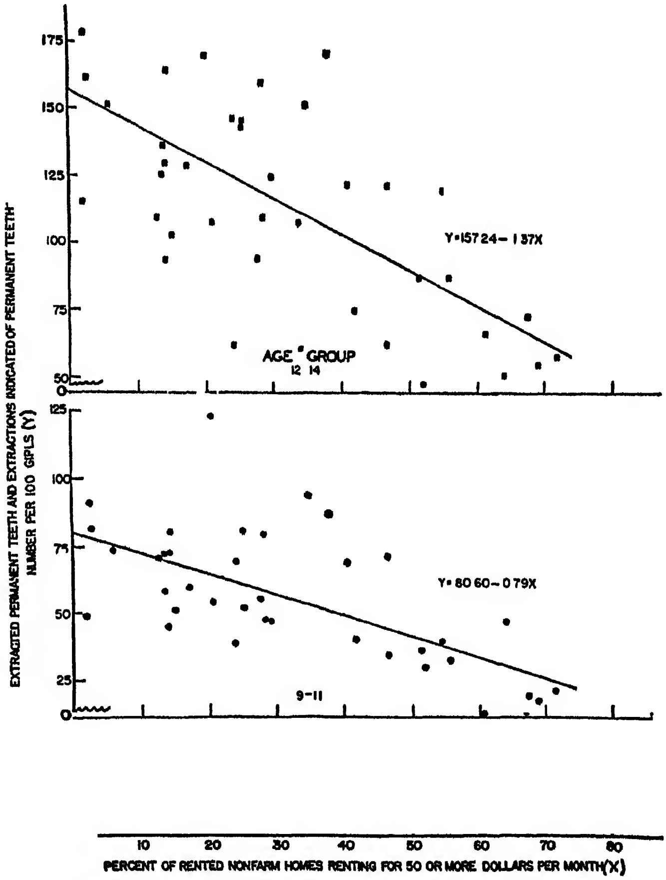

FIGURE 4. Scatter diagrams and fitted lines illustrating the relationship between community economic status and odontothanatosis, for girls 6-8, 9-11, and 12-14 years old. Data derived from observations in 40 urban communities of New Jersey.

shown by the data for girls given in figure 4, that the odontothanatotic rate decreases sharply with increase in community economic status. Similar findings may be shown for the boys.

DISCUSSION

Because of the limitations in the material available for the present study, and because all the issues involved are not immediately or completely discernible, it is not possible to give a well-rounded discussion of many of the pertinent questions which are suggested by

the analysis presented in the previous sections. On the other hand, it seems desirable to consider in at least a preliminary way one implication which follows from the study. Broadly this concerns the quantitative measurement of the results which may be expected to follow from providing remedial dental service to school children. From the analysis already given it is clear that economic variables markedly influence the provision of such care.

The development of methods of appraising objectively the value of public health procedures has become an important part of public health work. The crude death rate, mortality and morbidity rates for specific diseases, case fatality rates, and so on, have been found of considerable utility in assaying the effectiveness of general and specific health procedures. On the other hand, no clear-cut methods are as yet available for defining objectively and quantitatively the values resulting from the provision of dental health services to large groups of children. That there is need for the development of such techniques in the dental field is well recognized (*2, 3, 4, 19, 20*).

In approaching the problem of measuring the effectiveness of dental health services it is desirable to consider certain characteristic features of the disease for which these services are designed. The carious lesion consists essentially of a disintegration of the enamel surface by a process which is as yet incompletely understood. Usually before detection the lesion has penetrated into the underlying dentine, and if left unattended the pathology continues to penetrate toward and into the nutritive organ of the tooth, the dental pulp, a sequence of events which usually results in loss of vitality of the tooth.[7] Long clinical experience has shown that the progression of these events may be interrupted by the early surgical excision of the carious lesion followed by replacement of the affected area with inert filling materials resistant to disintegration.

Since lack of treatment of the carious lesion usually produces death of the affected teeth, it has been postulated (*2, 3*) that counts, in children, of the number of permanent teeth extracted and the number for which extraction is indicated provide a measure of the degree to which dental care conserves the masticatory apparatus as well as a technique for testing and comparing the efficacy of dental health procedures. Since the tooth death (odontothanatotic) rate appears to hold some promise as a measure of the effectiveness of dental care it becomes desirable to identify the factors which may influence the relationship between odontothanatosis and dental care. On the basis of general considerations it may be admitted at once that intensity of attack by caries constitutes one of these factors.

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[7] It is recognized that teeth with nonvital pulps may be successfully treated and maintained in serviceable condition in the mouth by means of pulp canal therapy. The prolonged treatment required to render the root canal and apical area bacteriologically negative is generally not selected by the patient who in most instances prefers extraction of the tooth.

Thus, because of variations in the intensity of attack by caries, the odontothanatotic rate may vary irrespective of the level of dental care. That wide differences do exist among children of different localities with respect to intensity of attack by caries is indicated in recent publications (*5*, *19*, *20*, *22*).

Another factor which undoubtedly affects the relationship between dental care and odontothanatosis is the length of time between initiation of a carious lesion and its treatment by filling.[10] Clearly the odontothanatotic rate may vary more exactly with respect to when the filling is placed in relation to when the cavity was initiated than with the number, *per se*, of fillings placed. Identification of this factor as a variable in the problem brings into focus an appreciation of the fact that little is known, in a quantitative sense, at the present time of the influence of this variable on the viability of teeth.

Although the data for the present study are deficient in certain respects they perhaps are adequate to provide some insight into the difficulties which must be encountered in any attempt to develop the odontothanatotic rate as an index of the efficacy of dental care. As indicated previously, a first problem in this connection concerns the study of the influence of intensity of attack by caries on the odontothanatotic rate. Table 5 provides information on this point and shows that the correlation coefficients for the relationship are small and statistically without clear-cut significance. However, those for the older age groups indicate that the number of odontothanatotic teeth observed per 100 New Jersey children tends to increase as the community caries experience rates increase. The interpretation of these coefficients must be integrated with those given in table 6 which show the relationship between intensity of attack by caries and dental care in the form of fillings. In these latter data, all the coefficients for the older age groups (9–11 and 12–14) are positive. However, they are clearly not statistically significant.

TABLE 5.—*Correlation coefficients and their respective standard deviations for the relationship between intensity of attack by caries (dMF) and odontothanatosis. Data derived from observations in 40 urban communities of New Jersey*

Sex	Age group (years)		
	6–8	9–11	12–14
Boys	0.11 ± 0.17	0.24 ± 0.15	0.13 ± 0.16
Girls	0.32 ± 0.15	0.16 ± 0.16	0.31 ± 0.15

[10] Obviously a tooth which is filled late in the development of a carious lesion is exposed to a greater risk of being rendered nonvital than one in which a cavity is filled early after its initiation. For purposes of precision and clarity the length of time a cavity remains untreated may be designated "cavity years of exposure to unattended caries."

A general interpretation of these two sets of data leads to the impression that an increase in the intensity of attack by caries is accompanied by a slight and perhaps questionable rise in the odontothanatotic and filled tooth rates. Expressed in other terms, the analysis would seem to justify the conclusion that the data at hand provide an opportunity to study the relationship of dental care and odontothanatosis in a situation where the factor, intensity of attack by caries, appears to affect only slightly the volumes of dental care and odontothanatosis.[11] The following study of the relation of dental care and odontothanatosis is undertaken, therefore, without quantitatively integrating into the relationship the slight influence of intensity of attack by caries.

TABLE 6.—*Correlation coefficients and their respective standard deviations for the relationship between intensity of attack by caries (dMF) and dental care (filled permanent teeth). Data derived from observations in 40 urban communities of New Jersey*

Sex	Age group (years)		
	6–8	9–11	12–14
Boys	−0.09±0.16	0.20±0.16	0.24±0.15
Girls	−0.04±0.17	0.28±0.15	0.16±0.16

A first step in the study of the relation consists of a derivation of the correlation coefficients for the two observations, filled teeth per 100 children and odontothanatotic teeth per 100 children. These coefficients, given in table 7, reveal that dental care in the form of fillings and odontothanatosis are indeed highly and inversely correlated in the New Jersey communities. It may be noted that all the coefficients are negative and, except for the youngest age group, all are above −0.58 and in every age-sex group the correlation is statistically significant. The high degree of association of the two variables made apparent by this analysis logically leads to an attempt to elucidate further the quantitative aspects of the relationship.

TABLE 7.—*Correlation coefficients and their respective standard deviations for the relationship between dental care (filled permanent teeth) and odontothanatosis. Data derived from observations in 40 urban communities of New Jersey*

Sex	Age group (years)		
	6–8	9–11	12–14
Boys	0.36±0.15	−0.58±0.11	−0.69±0.09
Girls	−0.47±0.13	−0.65±0.09	−0.67±0.09

[11] It is essential to understand that this, although true for the New Jersey communities, may not hold for other geographic areas.

Since the sequelae of attack by caries are slowly cumulative, the measurement of the changes in the odontothanatotic rate with change in volume of dental care would seem to be most advantageous in the oldest age group examined (12–14 years). Furthermore, it would seem satisfactory to make this analysis for both sexes combined.

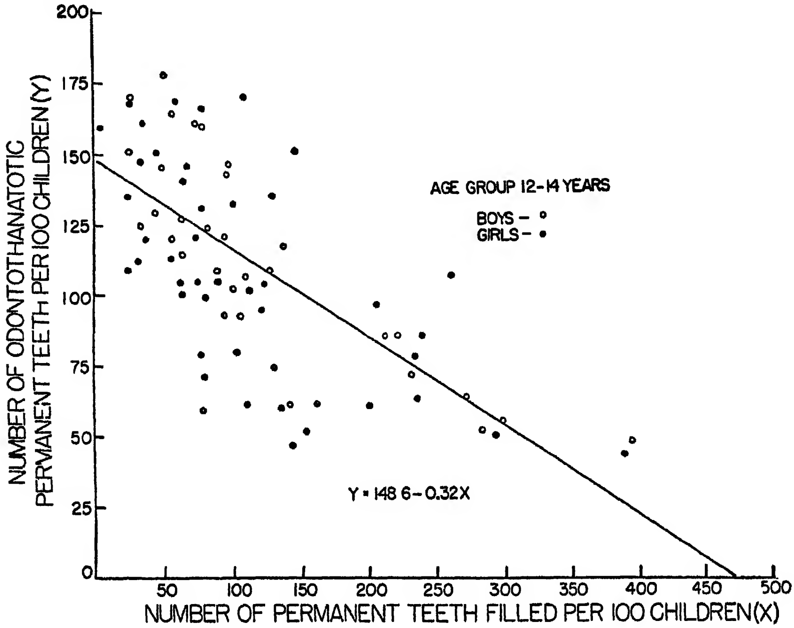

FIGURE 5.—Scatter diagram and fitted line illustrating the relationship between dental care (filled permanent teeth) and odontothanatosis, for 12–14-year-old boys and girls. Data derived from observations in 40 urban communities of New Jersey.

Accordingly the number of filled teeth and the number of odontothanatotic teeth, both expressed as rates per 100 children, were plotted against each other as shown in figure 5. The regression line fitted to these data was found to follow the equation:

$$y = 148.6 - 0.32x$$

Translating this expression into terms of the experience under consideration it may be seen that when, in a given community, there are 50 filled permanent teeth per 100 children there may be expected, on the average, of the order of 130 permanent teeth extracted or indicated for extraction per 100 children. On the other hand, when there are 300 filled permanent teeth per 100 children (12–14 years), an average of somewhat less than 60 teeth affected by odontothanatosis may be expected. The rate of decrease in the number of extractions and indicated extractions per unit increase in numbers of teeth filled (the slope of the regression line) is defined by the regression coefficient

which equals —0.32. Thus, the analysis reveals that the relationship under discussion is such that for each 3 teeth filled a saving, on the average, of 1 tooth (from extraction or indicated extraction) may be expected in the New Jersey children of the age group 12–14 years.

Needless to say, the quantitative derivations given immediately above are rough approximations. They cannot be considered to constitute a precise analysis of the quantitative relation between the two variables. On the other hand, it is necessary to recognize that dental care broadly considered markedly reduces the odontothanatotic process. The data on the New Jersey children, although deficient in many respects, and the analysis given, although open to criticism from many points of view, clearly demonstrate that those communities which provide large volumes of dental care derive great benefits in terms of the conservation of the permanent teeth, while those communities which provide small volumes of dental care pay a penalty measurable in terms of massive crippling of the teeth.

Although it is clear that dental care is a significant factor influencing the odontothanatotic rate it is necessary to emphasize again that many subsidiary variables may affect this relationship. Among these the length of time the carious lesions remain unattended (cavity years of exposure to unattended caries) is perhaps of the greatest significance. The excessive variability in the odontothanatotic rates shown in figure 5 for any given level of numbers of filled teeth is undoubtedly related to this variable. A community showing high levels of odontothanatosis, in spite of high levels of dental care in the form of fillings, may be one in which dental care is not provided in significant amounts until the children develop large and late carious defects. On the other hand a community may show low odontothanatotic rates in spite of intensive caries attack because fillings are placed systematically and early in the development of the carious lesions. This latter consideration also suggests that the development of a *precise* odontothanatotic index for measuring the efficacy of dental care must await further acquisitions in our knowledge of this and other essential variables in the dental problem.

CONCLUSIONS

Analyses of findings derived from a study of about 200,000 children in 40 urban communities of New Jersey lead to a number of rather significant general conclusions regarding the dental status of school children living under fairly representative conditions in the eastern section of the United States. First, although the basic data are not entirely satisfactory, the evidence available seems to indicate that the intrinsic tendency of children to experience attack of the permanent teeth by caries does not depend on the economic

status of the community in which the children live. Second, and the data on which the conclusion is based undoubtedly are sufficiently precise for the purpose, it is clear that the volume of dental care in the form of fillings in the permanent teeth increases markedly with increase in community economic level. Third, and perhaps most definitely, the odontothanatotic rate (the number of permanent teeth extracted and indicated for extraction per 100 children) diminishes as the economic level of the community rises.

A discussion of these findings leads to the conclusion that dental care in the form of fillings in the permanent teeth is highly and inversely correlated with deaths and extractions of teeth. From this consideration it is clear that the odontothanatotic rate may be viewed as a rough measure of the relative amount of dental care received by children of different localities. New Jersey communities having low odontothanatotic rates are, in general, characterized by relatively high levels of dental care, while those having high odontothanatotic rates usually are characterized by low filled-tooth rates. It is pointed out, however, that two other variables - intensity of attack by caries and the interval of time elapsing between the initiation and repair of carious defects—affect the odontothanatotic process. The quantitative significance of these latter factors in the loss of teeth, through devitalization and extraction, requires considerable investigation. It would appear justifiable, therefore, to conclude that present deficiencies in our knowledge make difficult the use of the odontothanatotic rate as a *precise* measure of the efficacy of providing dental care to school children.

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Appendix

TABLE 1A.—*Number of children examined and specified dental status rates by specified age and sex groups and by community economic index values. Data derived from 40 urban communities of New Jersey*

Community designation	Economic status[1]	Age group	Number of children examined		(d) Number of untreated carious defects per 100 children		Number of permanent teeth affected by specified condition per 100 children: (F) Filled		(m₁) Extracted		(m₂) Indicated extraction		(dMF)[2] Caries experience		(M) Extractions and indicated extractions	
			Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1	2.0	6–8	302	275	131	182	(3)	8	8	1	6	2	(3)	193	9	8
		9–11	380	332	201	204	20	27	24	23	29	26	334	370	53	49
		12–14	312	252	361	378	30	03	55	62	57	53	503	556	112	115
2	2.5	6–8	720	696	105	125	(3)	(3)	6	7	11	8	(3)	(4)	17	15
		9–11	789	766	206	224	15	16	32	40	44	51	297	331	76	91
		12–14	785	719	287	315	35	50	84	103	77	75	483	543	161	178
3	2.8	6–8	238	254	150	158	5	17	1	5	17	23	173	203	18	28
		9–11	311	289	230	230	46	50	27	27	55	55	358	371	82	82
		12–14	323	305	342	315	59	73	69	64	99	98	509	550	168	162
4	5.7	6–8	185	187	123	136	2	0	2	1	15	12	142	149	17	18
		9–11	218	217	250	276	12	26	15	20	51	54	328	376	66	74
		12–14	250	230	419	471	24	26	27	50	108	101	578	648	135	151
5	12.5	6–8	1	0	200	(3)	(3)	(3)	0	0	0	(3)	(3)	(3)	0	(3)
		9–11	28	26	275	265	64	52	4	86	79	35	422	388	83	71
		12–14	348	309	208	319	123	127	54	63	50	46	525	555	104	109

[1] The percentage of rented nonfarm homes renting for $50 or more per month.

[2] This rate is made up of a heterogeneous experience, namely, the number of dental caries defects in the permanent teeth, plus the number of extracted (and indicated extractions) permanent teeth, plus the number (irrespective of number of fillings) of filled permanent teeth per 100 children.

[3] Unknown or indeterminate.

TABLE 1A.- *Number of children examined and specified dental status rates by specified age and sex groups and by community economic index values. Data derived from 40 urban communities of New Jersey*– Continued

Community designation	Economic status	Age group	Number of children examined		(d) Number of untreated carious defects per 100 children		Number of permanent teeth affected by specified condition per 100 children									
							(F) Filled		(m_1) Extracted		(m_2) Indicated extraction		(dMF) Caries experience		(M) Extractions and indicated extractions	
			Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6	13.2	6-8	2,468	2,398	105	110	10	16	5	5	8	12	128	143	13	17
		9-11	3,061	3,024	184	183	53	68	32	34	36	37	305	322	68	71
		12-14	2,391	2,224	262	260	100	129	77	84	56	53	495	526	133	137
7	13.3	6-8	747	709	81	81	3	5	4	4	4	7	92	97	8	11
		9-11	852	835	144	156	22	20	20	29	26	29	221	234	55	58
		12-14	756	686	210	210	24	32	49	58	60	67	343	367	109	125
8	13.7	6-8	683	718	113	132	6	10	5	3	7	11	131	156	12	14
		9-11	900	917	203	202	17	27	17	25	38	47	275	301	55	72
		12-14	897	786	243	267	37	44	40	50	73	74	390	441	119	130
9	13.8	6-8	398	365	181	207	6	11	1	1	5	2	193	221	6	3
		9-11	435	388	313	296	42	51	14	19	26	20	395	392	40	15
		12-14	394	458	409	421	77	106	41	45	38	19	505	621	79	94
10	14.1	6-8	98	99	72	94	8	3	7	3	8	18	95	118	15	21
		9-11	159	151	117	157	8	19	26	27	52	55	203	258	78	82
		12-14	227	241	191	249	33	57	50	66	89	98	372	470	148	164
11	14.9	6-8	1,620	1,604	120	129	6	6	2	2	5	7	133	144	7	9
		9-11	1,859	1,809	208	216	36	51	22	23	27	28	293	318	49	51
		12-14	1,834	1,612	270	280	80	101	54	59	45	44	458	484	99	103
12	17.0	6-8	698	703	112	113	3	8	2	1	6	11	123	133	8	12
		9-11	858	806	189	194	32	45	13	20	36	40	270	299	49	60
		12-14	511	415	267	286	54	62	49	52	65	75	435	475	114	127
13	19.9	6-8	381	398	100	119	4	8	(3)	(3)	7	11	(3)	(1)	(1)	(1)
		9-11	405	422	223	222	44	46	(3)	(3)	37	40	(3)	(3)	(3)	(3)
		12-14	364	346	307	334	78	106	81	96	85	74	551	610	166	170
14	20.3	6-8	259	244	88	125	(3)	(3)	(3)	(3)	5	9	(3)	(1)	(1)	(3)
		9-11	577	656	217	224	24	34	44	51	69	73	354	382	113	124
		12-14	646	717	278	327	39	65	94	134	91	87	502	613	185	221
15	20.5	6-8	220	241	73	86	22	12	4	4	4	5	103	107	8	9
		9-11	227	237	167	159	53	63	23	30	22	25	265	277	45	55
		12-14	193	273	226	256	121	110	52	59	44	48	443	473	96	107
16	23.8	6-8	241	240	219	179	23	27	3	3	4	5	249	214	7	8
		9-11	295	258	273	273	68	86	13	15	19	23	373	397	32	38
		12-14	209	212	338	347	136	162	22	24	39	37	535	570	61	61
17	23.9	6-8	215	230	126	136	10	13	2	1	3	6	141	156	5	7
		9-11	402	414	287	287	41	66	26	32	30	36	384	421	56	68
		12-14	552	561	389	406	77	98	75	81	57	66	598	651	132	147
18	25.0	6-8	284	300	156	137	12	16	2	3	7	8	177	164	9	11
		9-11	352	335	202	208	62	80	24	25	42	27	330	340	66	52
		12-14	118	66	363	368	46	49	73	80	78	65	560	562	151	145
19	25.0	6-8	969	993	164	178	7	11	7	8	10	14	188	211	17	22
		9-11	1,234	1,360	263	286	44	59	27	32	45	49	379	426	72	81
		12-14	1,209	1,227	394	403	64	96	64	64	77	79	599	612	141	143
20	27.4	6-8	327	345	97	119	19	9	2	3	4	11	122	142	6	11
		9-11	447	401	174	200	55	73	16	16	35	39	280	328	51	55
		12-14	320	218	247	287	90	95	32	29	72	64	441	475	104	93
21	28.0	6-8	5,112	4,956	90	101	9	13	2	3	3	4	104	121	5	7
		9-11	5,715	5,664	194	200	43	50	19	23	21	24	277	297	40	47
		12-14	4,550	4,473	292	307	74	90	61	64	44	46	471	507	105	110
22	28.0	6-8	6,955	6,822	121	141	7	9	4	6	8	11	140	167	12	17
		9-11	8,097	8,022	214	218	33	45	34	39	38	40	319	312	72	79
		12-14	6,824	6,442	303	321	67	78	83	95	63	65	516	559	146	160

TABLE 1A.—*Number of children examined and specified dental status rates by specified age and sex groups and by community economic index values. Data derived from 40 urban communities of New Jersey*—Continued

Community designation	Economic status	Age group	Number of children examined		(d) Number of untreated carious defects per 100 children		Number of permanent teeth affected by specified condition per 100 children: (F) Filled		(m₁) Extracted		(m₂) Indicated extraction		(dMF) Caries experience		(M) Extractions and indicated extractions	
			Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
23	29.3	6-8	577	588	126	127	7	8	5	3	3	3	141	141	8	6
		9-11	617	607	205	280	43	55	21	16	25	31	384	382	46	47
		12-14	504	437	509	541	62	81	52	63	53	61	676	716	105	124
24	33.4	6-8	91	92	144	142	4	17	1	0	1	9	150	168	2	9
		9-11	173	176	186	181	116	163	13	18	22	19	337	381	35	37
		12-14	227	188	336	386	240	261	58	67	29	40	663	754	87	107
25	33.8	6-8	425	378	49	63	8	8	(3)	(3)	3	2	(4)	(4)	(3)	(3)
		9-11	410	375	99	117	45	59	15	19	16	20	175	215	31	39
		12-14	347	301	160	187	79	78	28	26	44	34	311	325	72	60
26	34.7	6-8	506	513	84	92	24	20	3	5	7	6	118	123	10	11
		9-11	572	569	201	226	68	73	63	65	24	30	356	394	87	95
		12-14	405	459	301	314	109	145	133	117	38	34	581	610	171	151
27	37.9	6-8	137	153	171	173	7	4	4	4	5	16	187	197	9	20
		9-11	259	254	219	280	21	28	33	45	27	43	330	396	60	88
		12-14	109	93	151	454	26	25	82	91	86	80	645	650	168	171
28	40.6	6-8	545	529	158	163	9	11	6	4	34	22	207	200	40	26
		9-11	797	841	231	249	53	82	22	23	42	45	348	399	64	68
		12-14	602	562	267	308	72	94	62	72	59	49	460	523	121	121
29	41.7	6-8	494	475	74	78	20	31	2	2	2	6	107	117	4	8
		9-11	492	462	137	136	68	87	8	15	20	24	233	262	28	39
		12-14	423	381	179	181	103	129	30	34	50	40	362	381	80	74
30	46.3	6-8	462	422	75	119	18	23	3	1	2	2	98	145	5	3
		9-11	525	566	152	160	74	86	15	21	15	13	256	280	30	34
		12-14	465	417	154	130	110	143	49	51	12	9	325	333	61	60
31	46.4	6-8	348	303	94	96	4	9	4	3	5	8	107	116	9	11
		9-11	383	367	210	222	51	70	11	16	29	55	301	363	40	71
		12-14	208	163	270	317	64	55	27	28	75	93	436	493	102	121
32	51.0	6-8	293	280	91	86	19	26	1	3	2	2	113	117	3	5
		9-11	301	280	165	188	128	127	6	13	17	22	316	350	23	35
		12-14	238	206	204	210	201	212	30	50	31	36	466	538	61	86
33	51.9	6-8	115	109	100	117	11	14	0	0	5	4	116	135	5	4
		9-11	132	126	226	205	75	158	0	5	20	22	321	390	20	27
		12-14	77	43	438	319	154	143	0	0	52	47	644	539	52	47
34	54.4	6-8	445	416	153	161	10	13	3	2	1	3	167	179	4	5
		9-11	405	411	264	296	56	71	24	20	14	19	358	409	38	39
		12-14	303	279	415	441	113	137	65	79	37	39	630	696	102	118
35	55.3	6-8	255	273	114	133	13	55	4	3	1	3	192	194	5	6
		9-11	226	242	271	221	118	188	31	28	8	5	428	412	39	33
		12-14	145	144	342	362	206	221	71	68	26	18	645	669	97	86
36	60.7	6-8	291	270	51	73	32	42	1	1	0	1	84	117	1	2
		9-11	311	313	90	93	154	151	5	8	3	4	252	256	8	12
		12-14	98	81	208	150	236	272	47	46	16	19	507	496	63	65
37	63.8	6-8	184	206	60	79	76	76	2	2	2	0	140	157	4	2
		9-11	236	216	128	134	238	264	36	36	5	10	407	414	41	46
		12-14	278	264	153	160	300	306	32	32	12	16	587	504	44	48
38	67.1	6-8	565	541	57	73	38	48	2	1	1	3	98	125	3	4
		9-11	553	533	121	116	171	213	10	10	10	8	315	347	20	18
		12-14	127	96	204	253	204	232	35	31	16	41	549	557	51	72
39	68.8	6-8	106	130	61	62	20	25	0	0	4	2	85	89	4	2
		9-11	125	126	113	125	138	198	11	7	6	10	268	340	17	17
		12-14	61	65	154	174	258	285	44	22	25	31	470	512	69	53
40	71.4	6-8	112	106	76	106	23	25	0	3	0	1	99	135	0	4
		9-11	103	106	180	198	134	138	12	15	9	6	335	357	21	21
		12-14	58	74	216	188	235	240	51	38	28	18	530	543	70	56

THE BURROWING OWL AS A HOST TO THE ARGASID TICK, *ORNITHODORUS PARKERI*[1]

By William L. Jellison, *Assistant Parasitologist, United States Public Health Service*

The argasid tick, *Ornithodorus parkeri* Cooley, has been reported from a variety of small mammalian hosts from Colorado, Montana, Utah, Washington, and Wyoming by Cooley (*1*) and Davis (*2*) The Washington record was of a single nymph collected from a cottontail rabbit near Yakima in June 1934.

Larvae, nymphs, and adults of ticks of this species usually engorge within one-half hour and leave their host to take shelter in the nests and burrows where they are sometimes present in considerable numbers. For this reason infestations on small mammals are not often found and seldom exceed a few immature specimens. Davis (*2*) reported the five heaviest infestations observed up to that time as 38, 44, 44, 44, and 46 nymphs and adults from the burrows of ground squirrels, *Citellus* spp., in Natrona County, Wyo., and Beaverhead County, Mont. Specimens collected from both areas proved to be infected with the spirochetes of relapsing fever.

In the State of Washington, in June 1939, 18 burrows and nests of the burrowing owl, *Speotyto cunicularia*, were examined for ectoparasites and other arthropods. This species of owl is of special interest because it is the only raptorial bird in North America that nests in burrows and because it has been found that ectoparasites, especially fleas from small mammals that have been carried to the nest for food, are trapped in the burrows and can be readily collected (*3*). Of the 18 burrows examined, 9 were infested with *O. parkeri*.

The ticks were found from within a few feet of the opening to the limits of the burrows, but were most abundant close to the nests. The burrows were often 3 or 4 feet underground and 10 to 15 feet long. A peculiar habit of the burrowing owl is to line its burrow and nest with horse manure, often to a depth of 2 or 3 inches. Some writers have claimed that this aids to keep down the flea population. Ticks were found throughout this material.

The following collections were made, and while the numbers indicate actual counts of specimens collected, they by no means represent all the ticks present in the burrows: Franklin County (June 2, 3, and 4) nest 105, 5 ticks; nest 106, 491 ticks; nest 107, 11 ticks; nest 108, 360 ticks. Yakima County (June 4 and 5) nest 109, 31 ticks; nest 112,

[1] Contribution from Rocky Mountain Laboratory, Hamilton, Mont, Division of Infectious Diseases, National Institute of Health An abstract of this paper is to be read at the meeting of the American Society of Parasitologists at Columbus, Ohio, December 27, 1939, and published in the abstract issue of the Journal of Parasitology

29 ticks. Douglas County (June 6) nest 115, 318 ticks. Okanogan County (June 7 and 9) nest 118, 49 ticks; nest 119, 24 ticks. Eight nests examined in Adams and Whitman Counties were not found infested.

Many of the ticks from nests containing fledglings were freshly engorged, as shown by the bright red intestinal contents visible through the semi-translucent body wall. Nineteen engorged ticks from nest 109 (Yakima County) were crushed and the intestinal contents smeared and stained. Nucleated erythrocytes of avian blood were readily distinguished on slides representing 17 ticks.

Nest 115, examined June 6 (about 4 miles south of Bridgeport, Douglas County) yielded 318 ticks in all stages of development. An adult owl was flushed from the entrance of the burrow and the nest contained the carcasses of 6 fledglings that had been recently killed by some predator, probably a weasel. According to the owner of the ranch on which this nest was located, the same burrow had been used by nesting owls every year since 1902.

The infested burrows were located along the valleys of the Columbia, Yakima, and Okanogan Rivers and were in sandy soil in semi-arid sagebrush or grass areas.

Though these infestations may have been initiated by ticks carried to the burrows on rodents, the extremely heavy infestations found and the fact that the ticks were feeding on the birds suggests that the relationship is one of long standing and that the burrowing owl, because of its nesting habits, is an accepted host, if not perhaps the most important host, of *O. parkeri* in this area. As these birds are migratory, at least in the northern part of their range, they may be an important factor in the dispersion of the tick.

Since Davis (*4*) listed the burrowing owl, "prairie dog owl," as a host of *Ornithodorus turicata* in Kansas, it is not unlikely that this owl will be found to harbor other *Ornithodorus* ticks in other parts of its range, which extends from southern South America northward well into Canada.

SUMMARY

The burrows and nests of the western burrowing owl, *Speotyto cunicularia*, have been found to harbor large numbers of the argasid tick, *Ornithodorus parkeri*. Infested burrows were found in Franklin, Douglas, Yakima, and Okanogan Counties, Washington. Although previous records indicated that *O. parkeri* is usually a parasite of small fossorial rodents, the heavy burrow infestations found and the finding of avian red cells in the intestinal contents of the ticks suggest the burrowing owl is an important host in the Northwest.

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PRELIMINARY MORTALITY SUMMARY FOR LARGE CITIES, 1939

The number of deaths reported in a group of 88 large cities during 1939 was 429,419, or 1 percent above the 1938 figure, 424,348, according to preliminary reports made public by the Bureau of the Census, Department of Commerce. The infant death rate in these cities was lower in 1939 than in 1938, the provisional rate for 1939 being 41 per 1,000 live births as compared with 43 per 1,000 live births in 1938.

The weekly death totals reported in these cities from January to July, inclusive, were consistently lower than the average totals for the preceding 3 years. During the remainder of the year, however, the 1939 weekly totals closely approximated the averages of the preceding 3 years. It is probable that the more favorable mortality record of 1939, as compared with the average of the preceding 3 years, is due to the smaller number of deaths from influenza and pneumonia during the winter and to the less extreme heat conditions during the summer.

The 25,713 infant deaths reported for 1939 represent a decrease of 1,446, or 5.3 percent, from the 27,159 reported for 1938. In the comparison of infant death rates for different cities, certain considerations must not be overlooked. Primarily, the effect of differences in sex, age, and racial composition of different cities must be evaluated before valid comparisons can be made.

The figures given in this annual summary are compiled from weekly telegraphic reports received by the Bureau of the Census from departments of health of the cities listed. In most cases the provisional figures collected in this way agree closely with final figures compiled by the Bureau of the Census from transcripts of death certificates. In order to assist in the evaluation of the 1939 provisional data, provisional figures for 1938 are given along with final figures for 1938.

All mortality figures given in the accompanying table are tabulated on the basis of place of death, not place of residence. Deaths given for any city, therefore, include many decedents not residents of that city, and exclude deaths of residents of the city occurring elsewhere.

Owing to the impracticability of making accurate estimates of city populations, total death rates for the cities are not computed. Therefore, direct comparisons between cities are not possible.

Provisional number of deaths and infant mortality for a group of 88 large cities in the United States for the 52-week period, January 1, 1939, to December 30, 1939

[From the Weekly Health Index, Bureau of the Census, Department of Commerce]

City	Number of deaths			Infant mortality					
				Number			Rate		
	Provisional		Final 1938[2]	Provisional		Final 1938[2]	Provisional		Final 1938[2,4]
	1939[1]	1938[1]		1939[1]	1938[1]		1939[3]	1938[3]	
Total (88 cities)	429, 419	424, 348	426, 498	25, 713	27, 159	28, 255	41	43	44
Akron	2, 074	2, 034	2, 054	123	151	160	30	36	38
Albany	1, 840	1, 780	1, 779	124	107	107	48	44	41
Atlanta	4, 279	4, 325	4, 310	421	441	450	61	67	69
White	2, 294	2, 374	2, 356	238	254	265	52	57	60
Negro	1, 984	1, 949	1, 952	182	187	185	79	88	86
Other	1	2	2	1	0	0	-------	0	-------
Baltimore	10, 840	11, 035	11, 091	634	812	816	43	52	53
White	8, 343	8 471	8, 515	400	530	536	35	44	45
Negro	2, 492	2, 550	2, 568	234	282	280	66	80	80
Other	5	8	8	0	0	0	-------	-------	-------
Birmingham	3, 507	3, 690	3, 707	340	402	409	62	73	77
White	1, 746	1, 821	1, 858	171	198	208	51	59	64
Negro	1, 761	1, 868	1, 908	160	204	201	78	94	97
Other	0	1	1	0	0	0	0	0	-------
Boston	11, 064	10, 739	10, 860	672	722	734	42	45	46
Bridgeport	1, 614	1, 603	1, 636	88	105	107	31	37	38
Buffalo	7, 056	7, 127	7, 122	439	568	580	44	55	56
Cambridge	1, 330	1, 382	1, 375	76	82	82	34	38	37
Camden	1, 461	1, 606	1, 601	148	163	164	44	50	49
Canton	1, 089	1, 133	1, 110	103	113	114	47	45	50
Chicago	35, 578	35, 068	35, 216	1, 516	1, 743	1, 764	31	34	34
Cincinnati	6, 700	6, 677	6, 692	362	414	423	41	46	46
Cleveland	9, 830	9, 560	9, 572	566	552	570	37	35	36
Columbus	4, 484	4, 245	4, 243	289	234	250	50	41	44
Dallas	3, 245	3, 257	3, 272	355	310	317	55	55	52
White	2, 462	2, 436	2, 449	266	234	238	49	50	46
Negro	783	821	823	89	76	79	88	83	84
Dayton	2, 633	2, 596	2, 619	182	215	214	39	46	47
Denver	4, 281	4, 313	4, 350	278	296	317	45	47	50
Des Moines	1, 708	1, 658	1, 813	97	91	135	28	29	42
Detroit	13, 125	12, 601	12, 817	1, 080	1, 155	1, 193	38	40	41
Duluth	1, 137	1, 202	1, 209	90	67	72	46	35	37
El Paso	1, 297	1, 389	1, 300	215	241	241	83	87	88
Erie	1, 483	1, 308	1, 293	73	83	99	29	30	37
Evansville	1, 333	1, 273	1, 312	106	123	128	51	63	61
Fall River	1, 517	1, 565	1, 568	108	102	101	54	52	64
Flint	1, 353	1, 209	1, 261	154	190	195	45	52	52
Fort Wayne	1, 400	1, 300	1, 285	78	72	69	37	34	33
Fort Worth	1, 850	1, 905	1, 905	156	161	173	47	49	51
White	1, 513	1, 557	1, 550	134	130	135	47	49	46
Negro	336	347	355	22	31	38	-------	-------	-------
Other	1	1	0	0	0	0	0	-------	-------
Grand Rapids	1, 855	1, 672	1, 668	127	142	140	46	47	47
Hartford	2, 107	2, 110	2, 124	102	129	142	23	31	34
Houston	4, 239	4, 137	4, 116	431	404	408	52	52	53
White	2, 975	2, 893	2, 882	293	280	282	44	43	45
Negro	1, 263	1, 243	1, 232	138	124	126	92	89	92
Other	1	1	2	0	0	0	-------	-------	-------
Indianapolis	5, 406	5, 325	5, 153	315	389	418	47	56	60
White	4, 598	4, 517	4, 361	265	325	348	45	53	56
Negro	807	807	790	50	64	70	60	78	85
Other	1	1	2	0	0	0	-------	-------	-------
Jersey City	3, 645	3, 507	3, 522	228	244	244	45	56	55

[1] Based on telegraphic reports received each week from city health officers.
[2] Calendar year; tabulation of transcripts received from State registrars' offices.
[3] The provisional infant mortality rate is computed from deaths under 1 year as reported each week, per 1,000 estimated live births for 1938 and 1939, respectively.
[4] Calendar year; the final infant mortality rate is the number of deaths under 1 year of age per 1,000 live births.

Provisional number of deaths and infant mortality for a group of 88 large cities in the United States for the 52-week period, January 1, 1939, to December 30, 1939—Continued

City	Number of deaths			Infant mortality					
				Number			Rate		
	Provisional		Final 1938	Provisional		Final 1938	Provisional		Final 1938
	1939	1938		1939	1938		1939	1938	
Kansas City, Kans	1,555	1,524	1,532	99	89	107	81	52	48
White	1,233	1,224	1,239	84	75	92	94	47	47
Negro	322	300	292	15	14	15			
Other	0	0	1	0	0	0		0	0
Kansas City, Mo	4,922	5,126	5,147	280	292	294	42	46	46
Knoxville	1,316	1,442	1,446	145	195	187	62	85	82
White	1,058	1,181	1,182	121	169	163	57	80	78
Negro	258	261	263	24	26	24			
Other	0	0	1	0	0	0	0	0	0
Long Beach	1,743	1,634	1,630	74	73	75	26	25	26
Los Angeles	17,306	16,809	16,849	915	882	891	45	43	43
Louisville	3,652	3,642	4,254	166	220	337	26	39	55
White	2,772	2,746	3,344	138	173	279	25	35	51
Negro	870	896	910	28	47	58	38	67	83
Other	1	0	0	0	0	0	0	0	0
Lowell	1,363	1,429	1,413	68	86	86	38	43	47
Lynn	1,059	1,044	1,040	36	38	41	21	23	29
Memphis	3,985	4,187	4,222	341	397	411	62	72	76
White	2,166	2,230	2,254	192	219	235	56	65	70
Negro	1,818	1,953	1,964	149	178	176	72	85	85
Other	1	4	4	0	0	0	0	0	0
Miami	1,741	1,672	1,667	141	111	117	53	45	47
White	1,340	1,243	1,247	86	75	78	42	40	41
Negro	397	425	416	53	36	39	92	62	67
Other	4	4	4	2	0	0			
Milwaukee	5,189	5,177	5,203	331	398	402	33	38	40
Minneapolis	5,370	5,081	5,190	272	265	301	30	31	34
Nashville	2,715	2,698	2,726	243	259	273	64	72	72
White	1,728	1,688	1,703	173	184	188	58	71	64
Negro	987	1,010	1,023	70	75	85	83	76	100
Newark, N. J	4,826	4,936	4,964	284	296	305	36	37	38
New Bedford	1,287	1,243	1,235	52	81	84	33	48	49
New Haven	2,134	1,984	2,010	69	48	101	32	21	30
New Orleans	7,734	8,033	8,073	708	808	832	64	77	81
White	4,739	4,872	4,900	326	437	439	49	64	68
Negro	2,995	3,161	3,167	382	371	393	89	101	103
Other	0	0	6	0	0	0	0	0	0
New York	75,362	73,634	73,788	3,794	3,902	3,888	38	38	38
Bronx Borough	11,905	11,338	11,368	462	494	490	31	33	33
Brooklyn Borough	25,730	25,128	25,142	1,393	1,512	1,510	35	37	38
Manhattan Borough	26,554	26,054	26,207	1,406	1,350	1,340	42	41	40
Queens Borough	8,856	8,829	8,765	457	446	448	42	39	39
Richmond Borough	2,317	2,285	2,306	76	100	100	32	42	40
Norfolk	1,358	1,338	1,639	56	115	149	23	47	66
White	738	731	899	23	48	67	14	32	46
Negro	617	606	739	33	67	82	39	73	102
Other	3	1	1	0	0	0	0	0	
Oakland	3,544	3,608	3,611	182	238	239	34	45	45
Oklahoma City	2,149	2,203	2,218	137	177	234	34	41	54
Omaha	2,798	2,762	2,684	171	158	170	41	34	38
Paterson	1,641	1,704	1,710	98	90	95	33	32	33
Peoria	1,383	1,466	1,459	103	130	130	39	48	46
Philadelphia	24,185	24,193	24,214	1,320	1,239	1,242	43	40	40
Pittsburgh	8,400	8,138	8,125	670	625	624	47	43	43
Portland, Oreg	4,002	4,001	4,003	177	149	156	33	29	31
Providence	3,111	3,254	3,280	212	220	222	38	39	40
Richmond	2,681	2,751	2,776	204	257	270	55	73	74
White	1,611	1,656	1,680	102	128	134	40	52	53
Negro	1,070	1,095	1,096	102	129	136	84	122	121
Rochester	3,620	3,558	3,563	175	192	196	32	36	36
St. Louis	10,698	10,681	10,596	337	417	582	24	30	41
St. Paul	2,971	2,932	3,009	153	136	164	29	25	30
Salt Lake City	1,736	1,769	1,803	141	177	186	36	45	48
San Antonio	3,519	3,318	3,335	642	524	517	99	82	81
White	3,226	3,052	3,065	624	506	502	100	83	82
Negro	288	259	264	18	18	15			
Other	5	7	6	0	0	0			
San Diego	2,481	2,435	2,446	125	152	153	34	39	40
San Francisco	8,721	8,533	8,512	245	225	251	28	26	29
Schenectady	967	973	977	56	51	53	37	34	35
Seattle	4,661	4,878	4,897	167	207	211	29	36	37

Provisional number of deaths and infant mortality for a group of 88 large cities in the United States for the 52-week period, January 1, 1939, to December 30, 1939—Continued

City	Number of deaths			Infant mortality					
				Number			Rate		
	Provisional		Final 1938	Provisional		Final 1938	Provisional		Final 1938
	1939	1938		1939	1938		1939	1938	
Somerville	936	965	962	36	54	52	31	45	40
South Bend	895	862	886	76	58	64	46	35	39
Spokane	1,586	1,609	1,611	102	101	111	39	39	42
Springfield, Mass	1,821	1,768	1,750	82	102	108	44	36	57
Syracuse	2,537	2,502	2,522	157	177	175	39	44	43
Tacoma	1,510	1,441	1,472	78	60	65	37	27	30
Tampa	1,212	1,166	1,162	88	72	85	51	40	46
White	911	820	824	53	42	56	39	29	38
Negro	300	346	337	34	30	29	--	--	--
Other	1	0	1	1	0	0		0	0
Toledo	3,653	3,510	3,522	217	223	236	42	44	46
Trenton	1,908	1,773	1,637	147	120	123	55	45	47
Utica	1,487	1,370	1,461	68	69	73	38	37	39
Washington, D. C	8,261	7,944	7,902	661	618	622	47	48	48
White	5,240	5,121	5,138	321	326	328	34	37	37
Negro	2,997	2,801	2,797	330	292	290	77	70	71
Other	24	22	27	1	0	4			
Waterbury	920	953	1,109	55	65	80	36	42	38
Wichita	1,441	1,329	1,159	90	69	87	38	28	38
Wilmington, Del	1,498	1,468	1,511	92	108	122	34	40	47
Worcester	2,520	2,517	2,451	135	124	131	38	35	37
Yonkers	1,185	1,164	1,243	19	62	65	27	37	35
Youngstown	1,714	1,706	1,718	115	135	144	33	38	40

MORTALITY DATA FOR 1938, BY CAUSE

The three accompanying tables are taken from special reports recently issued by the Bureau of the Census, Department of Commerce, and present mortality data for 1938 for specific causes and comparisons with 1936 and 1937.

Preliminary figures for total mortality, published several months ago, indicated a new low general death rate of 10.6 per 1,000 population in 1938 as compared with the previous minimum of 10.7 in 1933. The figures given in the present tables reveal the important sources contributing to the favorable mortality picture.

With the exception of measles, the deaths from the four important diseases of childhood remained low, the number of influenza deaths was less than half that in 1936 or 1937, pulmonary tuberculosis caused about 5,000 fewer deaths than in 1937 and 7,000 less than in 1936, heart disease (except diseases of the coronary arteries and angina pectoris) showed a decline, as did also nephritis, while pneumonia caused only 87,923 deaths as compared with 110,009 in 1937 and 119,378 in 1936.

Another important reduction, though not strictly of public health concern is that shown in the number of deaths from automobile accidents, which decreased nearly 7,000 as compared with 1937.

An additional bright spot in the 1938 mortality picture is the continued reduction in the number of deaths due to puerperal causes, the rate for which has been steadily declining for several years.

On the other hand, 1938 again brought increases in mortality from cancer, diabetes, chronic rheumatic heart disease, and diseases of the coronary arteries and angina pectoris, conditions which principally concern the older age groups.

These changes have shifted the relative position of two of the five numerically most important causes of death. Diseases of the heart and cancer retain first and second place, respectively, while cerebral hemorrhage jumped from fifth to third place, taking the position held last year by pneumonia, which dropped to fifth. Nephritis remained fourth on the list.

The decline in mortality from pneumonia which occurred in 1938 is believed to have great significance. The 1938 death rate of 67.5 per 100,000 population is the lowest recorded for the United States since the death registration area was established in 1900. In this connection it should be noted that as compared with the 1937 rate of 85.1 the 1938 rate shows a decline of 20 percent, the most pronounced drop since 1927.

The observed decrease in pneumonia deaths is no doubt due in part to the low influenza mortality, and in part to extended application of modern therapy in pneumonia cases.

Number of deaths (exclusive of stillbirths) from selected causes, and death rates in the United States, 1936–38 [1]

[Number and rate for 1938 are provisional]

Cause of death	Number of deaths			Rate per 100,000 estimated population		
	1938	1937	1936	1938	1937	1936
Total deaths	1,381,301	1,450,427	1,479,228	1,060.9	1,122.1	1,151.8
Typhoid and paratyphoid fever (1, 2)	2,418	2,743	3,182	1.9	2.1	2.5
Measles (7)	3,206	1,501	1,267	2.5	1.2	1.0
Scarlet fever (8)	1,206	1,824	2,493	.9	1.4	1.9
Whooping cough (9)	4,778	4,981	2,666	3.7	3.9	2.1
Diphtheria (10)	2,556	2,637	3,065	2.0	2.0	2.4
Influenza (11)	16,520	38,005	33,811	12.7	29.4	26.3
Dysentery (13)	2,933	2,974	3,122	2.3	2.3	2.4
Erysipelas (15)	712	1,246	2,006	.5	1.0	1.6
Acute poliomyelitis and acute polioencephalitis (16)	487	1,461	780	.4	1.1	.6
Epidemic cerebrospinal meningitis (18)	1,024	2,208	3,020	.8	1.7	2.4
Tuberculosis of the respiratory system (23)	58,027	63,330	65,043	44.6	49.0	50.6
Tuberculosis (all other forms) (24–32)	5,709	5,994	6,484	4.4	4.6	5.0
Syphilis (34)	12,670	13,221	12,612	9.7	10.2	9.8
Malaria (38)	2,378	2,729	3,943	1.8	2.1	3.1
Cancer of digestive tract and peritoneum (46)	70,807	69,335	68,239	54.4	53.6	53.1
Cancer of uterus and other female genital organs (48, 49)	20,235	19,981	19,833	15.5	15.5	15.4
Cancer of the breast (50)	14,460	13,939	13,708	11.1	10.8	10.7
Cancer (all other forms) (45, 47, 51–53)	43,712	41,519	40,838	33.6	32.1	31.8
Acute rheumatic fever (56)	2,019	1,958	2,175	1.6	1.5	1.7
Chronic rheumatism, osteoarthritis (57)	1,697	1,748	1,829	1.3	1.4	1.4
Diabetes mellitus (59)	31,037	30,587	30,406	23.8	23.7	23.7
Pellagra (62)	3,205	3,258	3,740	2.5	2.5	2.9
Alcoholism (acute or chronic) (75)	2,569	3,305	3,714	2.0	2.6	2.9
Progressive locomotor ataxia (tabes dorsalis), general paralysis of insane (80, 83)	5,331	5,055	5,453	4.1	3.9	4.2

[1] Vital Statistics—Special Reports, vol. 9, No. 7, p. 15 (Dec. 29, 1939). Bureau of the Census, Department of Commerce.

Number of deaths (exclusive of stillbirths) from selected causes, and death rates in the United States, 1936–38—Continued

Cause of death	Number of deaths			Rate per 100,000 estimated population		
	1938	1937	1936	1938	1937	1936
Cerebral hemorrhage, cerebral embolism and thrombosis (82)	111,567	111,753	116,562	85.7	86.5	90.8
Chronic rheumatic heart diseases (90a, 92c, 93e, 95c)	9,429	7,454		7.2	5.8	
Diseases of coronary arteries and angina pectoris (94)	77,444	69,758		59.5	54.0	
Heart diseases (all other forms) (90b, 91, 92a, b, 93a–d, 95a, b)	263,295	269,189	341,350	202.2	208.3	265.8
Arteriosclerosis (except coronary), idiopathic anomalies of blood pressure (97, 102)	22,208	23,050	23,893	17.1	17.8	18.6
Pneumonia (all forms) (107–109)	87,923	110,009	119,378	67.5	85.1	93.0
Ulcer of stomach and duodenum (117)	8,403	8,765	8,566	6.5	6.8	6.7
Diarrhea and enteritis (under 2 years) (119)	14,107	14,406	15,612	10.8	11.1	12.2
Diarrhea and enteritis (2 years and over) (120)	4,401	4,519	5,339	3.4	3.5	4.2
Appendicitis (121)	14,300	15,340	16,480	11.0	11.9	12.8
Hernia, intestinal obstruction (122)	12,612	13,111	13,433	9.7	10.1	10.5
Cirrhosis of the liver (124)	10,808	10,960	10,587	8.3	8.5	8.2
Biliary calculi and other diseases of the gall bladder and biliary passages (126, 127)	8,469	8,636	8,863	6.5	6.7	6.9
Nephritis (130–132)	100,520	102,877	106,865	77.2	79.6	83.2
Puerperal septicemia (140, 142a, 145)	3,333	3,727	4,606	2.6	2.9	3.6
Puerperal albuminuria and eclampsia, other toxemias of pregnancy (146, 147)	2,521	2,717	2,784	1.9	2.1	2.2
Other puerperal causes (141, 142b–144, 148–150)	4,099	4,325	4,792	3.1	3.3	3.7
Congenital malformations (157)	12,102	11,842	12,093	9.3	9.2	9.4
Suicide (163–171)	19,802	19,294	18,294	15.2	14.9	14.2
Homicide (172–175)	8,799	9,811	10,232	6.8	7.6	8.0
Automobile accidents (primary) (210)	30,564	37,205	35,761	23.5	28.8	27.8
Other motor vehicle accidents (206, 208, 211)	2,018	2,438	2,328	1.5	1.9	1.8
Other accidents (176–195, 201–205, 207, 209, 212–214)	61,223	65,562	71,963	47.0	50.7	56.0
All other causes [2]	181,658	188,131	196,023	139.5	145.5	152.6

[2] Refer to complete International List titles.

Number of deaths from all puerperal causes and death rates (number per 1,000 live births) in the United States, 1934–38 [1]

Cause of death	Number of deaths					Rate per 1,000 live births				
	1938	1937	1936	1935	1934	1938	1937	1936	1935	1934
All puerperal causes	9,953	10,769	12,182	12,544	12,859	4.35	4.88	5.68	5.82	5.93
Abortion with septic conditions	1,380	1,531	1,801	2,167	2,204	.60	.69	.83	1.00	1.01
Abortion without mention of septic condition (to include hemorrhage)	436	582	680	602	570	.19	.26	.31	.27	.26
Ectopic gestation	437	461	486	545	571	.19	.20	.22	.25	.26
With septic condition specified	79	83	100	105	106	.03	.03	.04	.04	.04
Without mention of septic condition	358	378	386	440	465	.15	.17	.17	.20	.21
Other accidents of pregnancy (not to include hemorrhage)	104	90	80	84	94	.04	.04	.03	.03	.04
Puerperal hemorrhage	1,320	1,319	1,398	1,370	1,404	.57	.59	.65	.63	.64
Placenta praevia	355	353	400	425	432	.15	.16	.18	.19	.19
Other puerperal hemorrhages	965	966	998	945	972	.42	.43	.46	.43	.44
Puerperal septicemia (not specified as due to abortion)	1,874	2,113	2,705	2,902	2,808	.81	.95	1.26	1.34	1.29
Puerperal septicemia and pyemia	1,873	2,105	2,697	2,897	2,800	.81	.95	1.25	1.34	1.29
Puerperal tetanus	1	8	8	5	8	(2)	(2)	(2)	(2)	(2)
Puerperal albuminuria and eclampsia	2,023	2,161	2,235	2,229	2,431	.88	.98	1.04	1.03	1.12
Other toxemias of pregnancy	498	556	549	497	559	.21	.25	.25	.23	.25
Puerperal phlegmasia, alba dolens, embolus, sudden death (not specified as septic)	524	495	567	578	561	.22	.22	.26	.26	.2[illegible]
Other accidents of childbirth	1,338	1,423	1,635	1,543	1,621	.58	.64	.76	.71	.7[illegible]
Cesarean operation	376	367	409	336	416	.16	.16	.19	.15	.1[illegible]
Others under this title	962	1,056	1,226	1,207	1,205	.42	.47	.57	.56	.5[illegible]
Other and unspecified conditions of the puerperal state	19	38	46	27	36	(2)	.01	.02	.01	.0[illegible]

[1] Vital Statistics—Special Reports, vol. 9, No. 5, p. 9 (Dec. 28, 1939). Bureau of the Census, Department of Commerce.
[2] Less than one-hundredth of 1 per 1,000 live births.

Summary of fatalities due to motor-vehicle accidents in the United States, 1936-38[1]

Area	All motor-vehicle accidents			Automobile accidents (except collisions with railroad trains and street cars)		
	1938	1937	1936	1938	1937	1936
United States	32,582	39,643	38,089	30,564	37,205	35,761
Alabama	638	686	698	599	654	667
Arizona	214	257	242	205	249	234
Arkansas	311	375	433	296	361	419
California	2,784	3,152	3,123	2,573	2,913	2,886
Colorado	353	411	388	333	386	363
Connecticut	351	438	450	341	426	441
Delaware	75	106	87	73	103	84
District of Columbia	134	179	165	129	170	159
Florida	742	744	687	689	715	652
Georgia	803	968	995	761	908	938
Idaho	183	192	188	160	182	180
Illinois	2,167	2,559	2,477	1,968	2,342	2,183
Indiana	1,161	1,447	1,374	1,028	1,253	1,187
Iowa	500	616	567	451	545	507
Kansas	446	502	580	396	431	534
Kentucky	651	831	699	616	799	666
Louisiana	509	509	582	490	496	560
Maine	187	210	215	182	203	202
Maryland	381	536	462	377	519	452
Massachusetts	682	800	890	664	875	875
Michigan	1,485	2,188	1,930	1,417	2,052	1,813
Minnesota	652	672	710	602	610	663
Mississippi	405	463	519	385	435	487
Missouri	886	1,029	1,022	836	959	964
Montana	143	177	174	136	168	168
Nebraska	233	336	310	212	297	290
Nevada	66	66	74	63	65	71
New Hampshire	116	152	120	106	146	110
New Jersey	905	1,304	1,129	869	1,266	1,094
New Mexico	156	208	207	153	204	204
New York	2,548	3,076	2,767	2,453	2,969	2,647
North Carolina	910	1,045	979	858	1,009	930
North Dakota	121	124	135	104	111	129
Ohio	1,985	2,675	2,426	1,784	2,441	2,167
Oklahoma	514	650	660	510	608	633
Oregon	339	366	369	326	341	347
Pennsylvania	2,035	2,636	2,461	1,949	2,506	2,359
Rhode Island	83	127	114	82	121	111
South Carolina	477	572	590	459	520	571
South Dakota	145	115	129	139	105	123
Tennessee	588	736	786	559	699	758
Texas	1,786	2,102	1,994	1,715	2,033	1,921
Utah	220	205	187	186	193	180
Vermont	91	100	102	79	91	95
Virginia	696	843	840	674	811	792
Washington	494	556	631	471	537	601
West Virginia	393	476	516	376	446	501
Wisconsin	711	891	783	637	801	720
Wyoming	97	135	114	93	131	114

[1] Vital Statistics—Special Reports, vol. 9, No. 8, p. 17 (Dec. 20, 1939). Bureau of the Census, Department of Commerce.

DEATHS DURING WEEK ENDED JANUARY 13, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Jan. 13, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,716	9,182
Average for 3 prior years	9,824	
Total deaths, first 2 weeks of year	18,966	18,324
Deaths under 1 year of age	558	514
Average for 3 prior years	581	
Deaths under 1 year of age, first 2 weeks of year	1,125	1,111
Data from industrial insurance companies:		
Policies in force	66,406,002	68,293,176
Number of death claims	12,708	13,728
Death claims per 1,000 policies in force, annual rate	10.0	10.5
Death claims per 1,000 policies, first 2 weeks of year, annual rate	9.0	8.8

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JANUARY 27, 1940

Summary

A total of 13,242 cases of influenza was reported for the current week, as compared with 12,568 cases for the preceding week and with 3,395 for the corresponding period in 1939, which was also the median week for the 5 years, 1935-1939.

The highest incidence of influenza continues to prevail in the South Atlantic and South Central States, which reported 12,629 cases, or more than 95 percent of the total. The greatest increases are shown for Virginia, from 1,128 to 2,107 cases, and Texas, from 1,405 to 2,158 cases. Some increase occurred also in the three Pacific States Washington, Oregon, and California—which reported 708 cases, as compared with 494 for the preceding week. The effect of these increases was almost nullified, however, by decreases in other States. It may be of interest to note that the peak week for influenza for the 5-year median occurred during the seventh week of the year and that for 1939 during the tenth week (March 11), when 18,135 cases were reported.

The favorable conditions with respect to the other 8 communicable diseases continue to prevail, all of which, with the exception of poliomyelitis, have remained below the 5-year median expectancy; and that disease is now approaching the median.

Telegraphic morbidity reports from State health officers for the week ended January 27, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Jan. 27, 1940	Jan. 28, 1939		Jan. 27, 1940	Jan. 28, 1939		Jan. 27, 1940	Jan. 28, 1939		Jan. 27, 1940	Jan. 28, 1939	
NEW ENG.												
Maine	4	10	2	31	10	10	154	8	143	0	0	0
New Hampshire	0	0	0	---	1	1	6	2	12	0	0	0
Vermont	1	0	0	---	---	---	22	17	17	0	0	0
Massachusetts	4	4	5	---	---	---	210	551	341	2	2	2
Rhode Island	0	0	0	---	---	---	98	7	31	1	0	0
Connecticut	2	2	2	4	4	18	164	507	347	0	1	1
MID. ATL.												
New York	28	28	40	[1] 16	[1] 155	[1] 21	212	1,214	823	3	4	7
New Jersey	1	13	13	32	19	19	28	25	139	0	0	1
Pennsylvania	26	53	48	---	---	---	52	140	518	15	7	7
E. NO. CEN.												
Ohio	23	37	37	21	---	7	38	21	65	2	0	9
Indiana	20	18	29	25	4	47	16	15	165	1	0	1
Illinois	33	46	45	79	30	35	32	31	47	0	4	5
Michigan [2]	9	8	18	12	2	4	354	427	270	1	2	2
Wisconsin	3	5	3	64	47	53	214	547	547	1	0	0
W. NO. CEN.												
Minnesota	1	7	5	8	2	2	235	1,257	104	0	1	1
Iowa	8	6	6	22	2	7	78	136	98	0	0	2
Missouri	8	26	26	26	33	214	4	8	21	1	2	2
North Dakota	2	4	4	42	6	11	6	297	18	0	1	1
South Dakota	0	5	3	4	2	---	5	397	14	0	0	0
Nebraska	5	0	0	---	1	4	28	32	32	1	0	1
Kansas	4	7	9	142	6	25	213	8	41	0	0	1
SO. ATL.												
Delaware	2	5	1	---	---	---	0	0	11	0	0	0
Maryland [2]	2	6	7	132	10	47	7	853	137	0	1	3
Dist. of Col.	4	8	7	19	---	4	1	22	22	0	1	2
Virginia	17	23	23	2,107	617	---	41	135	180	1	5	5
West Virginia	17	17	17	53	41	61	4	11	12	1	2	2
North Carolina [3]	10	18	31	122	9	34	42	565	505	0	2	3
South Carolina [3]	10	15	5	2,169	649	711	11	5	28	0	0	1
Georgia [3]	4	8	14	1,249	110	193	24	39	0	0	0	2
Florida	5	10	10	62	5	13	33	72	25	0	0	1
E. SO. CEN.												
Kentucky	13	11	11	59	27	46	23	48	51	1	5	8
Tennessee	3	8	15	325	109	185	47	133	96	2	2	5
Alabama [3]	12	12	23	900	109	362	40	116	116	3	2	2
Mississippi [3]	2	8	8	---	---	---	---	---	---	1	1	1
W. SO. CEN.												
Arkansas	10	8	10	1,859	139	139	19	32	18	0	1	1
Louisiana	6	35	19	42	8	12	2	191	56	0	1	0
Oklahoma	8	13	10	373	193	193	2	111	32	1	0	2
Texas [4]	85	58	64	2,158	703	703	196	75	75	0	4	3
MOUNTAIN												
Montana	0	3	3	9	50	57	32	405	51	2	0	0
Idaho	8	0	1	1	1	6	148	61	64	0	0	0
Wyoming	1	1	0	2		---	10	45	9	0	0	0
Colorado	8	24	9	27	45	---	27	48	48	0	1	1
New Mexico	0	2	4	19	10	10	9	29	29	0	0	0
Arizona	8	8	3	271	81	130	10	1	2	0	1	0
Utah [2]	0	0	0	45	9	---	149	37	37	1	0	0
PACIFIC												
Washington	8	1	1	13	---	---	801	113	94	0	0	1
Oregon	9	2	2	221	53	53	147	22	22	1	0	1
California [3]	24	28	31	474	33	144	389	2,025	239	0	2	3
Total	383	601	601	13,212	3,305	3,305	4,383	10,844	10,844	12	55	104
4 weeks	1,829	2,489	2,507	47,956	12,765	12,765	15,633	30,655	30,655	120	210	377

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended January 27 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Jan. 27, 1940	Jan. 28, 1939		Jan. 27, 1940	Jan. 28, 1939		Jan. 27, 1940	Jan. 28, 1939		Jan. 27, 1940	Jan. 28, 1939	
NEW ENG.												
Maine	0	0	0	17	13	21	0	0	0	1	1	0
New Hampshire	0	0	0	8	8	11	0	0	0	0	2	0
Vermont	0	0	0	11	6	11	0	0	0	0	0	0
Massachusetts	0	0	0	139	194	249	0	0	0	1	3	1
Rhode Island	0	0	0	8	20	20	0	0	0	0	0	0
Connecticut	0	0	0	82	74	74	0	0	0	10	0	0
MID. ATL.												
New York	0	0	0	597	556	677	0	0	0	6	6	6
New Jersey	0	1	1	256	177	172	0	0	0	0	0	0
Pennsylvania	0	0	1	388	351	602	0	0	0	10	10	6
E. NO. CEN.												
Ohio	1	0	0	376	495	486	1	19	8	0	7	1
Indiana	1	0	0	188	218	211	7	56	2	1	0	0
Illinois	1	1	1	489	524	584	1	10	17	1	3	3
Michigan [2]	0	0	0	317	571	560	0	2	1	2	1	3
Wisconsin	0	0	0	167	289	318	2	15	13	1	0	2
W. NO. CEN.												
Minnesota	2	0	0	125	169	160	13	17	15	0	4	1
Iowa	6	0	0	71	123	191	11	46	24	2	0	1
Missouri	0	0	0	86	129	210	2	10	10	2	2	2
North Dakota	0	0	0	23	21	29	0	10	10	0	0	0
South Dakota	0	0	0	16	21	44	0	9	4	0	0	0
Nebraska	0	0	0	36	43	57	0	3	3	0	4	2
Kansas	1	0	0	114	169	213	0	21	11	0	6	1
SO. ATL.												
Delaware	0	0	0	14	0	14	0	0	0	0	0	0
Maryland [2]	0	0	0	54	50	67	0	0	0	2	4	2
Dist. of Col.	0	0	0	31	13	16	0	0	0	0	0	0
Virginia	0	0	0	68	47	47	3	0	0	3	2	5
West Virginia	2	2	0	60	65	51	0	0	0	0	6	3
North Carolina [3]	0	2	1	48	58	50	0	0	0	0	4	5
South Carolina [3]	1	1	0	7	14	6	0	0	0	2	3	2
Georgia [3]	0	0	0	12	18	18	0	2	0	4	3	3
Florida	0	3	0	6	14	11	1	0	0	0	1	1
E. SO. CEN.												
Kentucky	1	1	0	61	71	67	0	3	0	0	0	2
Tennessee	0	0	0	54	53	41	0	1	0	0	2	2
Alabama [1]	2	0	1	16	13	14	0	1	1	0	3	2
Mississippi [2]	0	0	0	4	12	11	0	1	0	1	1	1
W. SO. CEN.												
Arkansas	0	0	0	13	18	9	2	1	2	3	2	3
Louisiana	0	3	1	18	16	16	0	0	0	3	21	4
Oklahoma	1	0	0	43	54	49	0	48	6	0	7	3
Texas [4]	1	2	2	66	114	110	5	29	2	4	11	11
MOUNTAIN												
Montana	1	1	0	30	24	35	0	4	7	0	2	1
Idaho	1	0	0	4	9	29	0	15	3	7	0	0
Wyoming	0	0	0	14	11	12	0	1	1	0	0	0
Colorado	0	0	0	36	41	41	4	8	4	1	1	1
New Mexico	0	0	0	16	37	23	0	5	0	6	1	2
Arizona	0	0	0	14	2	20	0	24	0	3	0	0
Utah [4]	1	0	0	25	23	72	0	0	0	0	1	0
PACIFIC												
Washington	0	0	0	61	73	74	0	2	15	0	0	1
Oregon	0	0	0	46	70	70	0	15	11	0	0	0
California [5]	10	0	2	192	252	252	3	10	4	3	5	5
Total	33	17	26	4,527	5,313	6,359	55	388	275	79	120	101
4 weeks	151	67	85	16,487	20,581	23,606	319	1,548	1,114	320	458	404

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended January 27, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended— Jan. 27, 1940	Whooping cough, Week ended— Jan. 28, 1939	Division and State	Whooping cough, Week ended— Jan. 27, 1940	Whooping cough, Week ended— Jan. 28, 1939
NEW ENG.			SO. ATL.—continued		
Maine	130	18	South Carolina [3]	8	66
New Hampshire	7	0	Georgia [3]	9	27
Vermont	139	79	Florida	5	11
Massachusetts	104	189	E. SO. CEN.		
Rhode Island	4	60	Kentucky	84	16
Connecticut	78	143	Tennessee	18	22
MID. ATL.			Alabama [3]	10	57
New York	405	653	Mississippi [2]		
New Jersey	69	422	W. SO. CEN.		
Pennsylvania	349	441	Arkansas	17	13
E. NO. CEN.			Louisiana	1	1
Ohio	80	265	Oklahoma	5	5
Indiana	23	5	Texas [3]	60	128
Illinois	85	389	MOUNTAIN		
Michigan [2]	102	2 9	Montana	5	14
Wisconsin	103	300	Idaho	6	2
W. NO. CEN.			Wyoming	12	0
Minnesota	47	52	Colorado	32	74
Iowa	5	21	New Mexico	62	26
Missouri	11	23	Arizona	12	8
North Dakota	0	1	Utah [2]	149	25
South Dakota	2	8	PACIFIC		
Nebraska	3	0	Washington	29	18
Kansas	22	7	Oregon	29	15
SO. ATL.			California [3]	106	112
Delaware	7	5	Total	2,078	4,406
Maryland [2]	86	31	4 weeks	10,405	17,459
Dist. of Col.	1	25			
Virginia	21	74			
West Virginia	32	29			
North Carolina [3]	44	302			

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Jan. 27, 1940, 23 cases as follows: North Carolina, 2; South Carolina, 3; Georgia, 12; Alabama, 2; Texas, 3; California, 1.

CASES OF VENEREAL DISEASES REPORTED FOR NOVEMBER 1939

These reports are published monthly for the information of health officers in order to furnish current data as to the prevalence of the venereal diseases. The figures are taken from reports received from State and city health officers. They are preliminary and are therefore subject to correction. It is hoped that the publication of these reports will stimulate more complete reporting of these diseases.

Reports from States

	Syphilis		Gonorrhea	
	Cases reported during month	Monthly case rates per 10,000 population	Cases reported during month	Monthly case rates per 10,000 population
Alabama	1,445	4.94	315	1.08
Arizona	181	4.33	133	3.18
Arkansas	1,002	4.83	241	1.16
California	2,126	3.40	1,817	2.90
Colorado	87	.81	50	.46
Connecticut	159	.91	111	.63
Delaware	226	8.59	30	1.14
District of Columbia	655	10.30	219	3.44
Florida	1,829	10.77	136	.80
Georgia	2,830	9.09	36	.12
Idaho	31	.62	20	.40
Illinois	1,982	2.50	1,197	1.51
Indiana	711	2.04	126	.36
Iowa	189	.74	116	.45
Kansas	216	1.16	92	.40
Kentucky	758	2.56	309	1.04
Louisiana	720	3.39	86	.40
Maine	28	.33	46	.53
Maryland	1,140	6.77	281	1.67
Massachusetts	419	.95	426	.96
Michigan	976	2.00	583	1.19
Minnesota	243	.91	196	.73
Mississippi	1,876	9.20	2,298	11.26
Missouri	601	1.49	216	.54
Montana	60	1.10	60	1.10
Nebraska	39	.29	57	.42
Nevada	10	.98	9	.88
New Hampshire	17	.33	8	.16
New Jersey	914	2.10	285	.65
New Mexico	133	3.15	57	1.35
New York	3,332	2.57	1,281	.99
North Carolina	2,375	6.73	378	1.07
North Dakota	42	.59	53	.75
Ohio	944	1.40	384	.57
Oklahoma	654	2.54	253	.98
Oregon	126	1.21	116	1.12
Pennsylvania	1,370	1.34	120	.12
Rhode Island	77	1.13	54	.79
South Carolina	1,089	5.76	254	1.34
South Dakota	45	.65	19	.27
Tennessee	1,147	3.92	315	1.08
Texas	3,899	6.26	638	1.02
Utah	44	.84	32	.61
Vermont	18	.47	19	.49
Virginia	1,612	5.88	335	1.22
Washington	219	1.31	316	1.89
West Virginia	220	1.16	78	.41
Wisconsin	62	.21	110	.37
Wyoming	18	.76	12	.51
Alaska	18	2.87	21	3.35
Hawaii	83	2.05	76	1.88
Total	39,003	2.98	14,420	1.10

Reports from cities of 200,000 population or over [1]

Akron, Ohio	53	1.93	32	1.16
Atlanta, Ga	380	12.66	77	2.56
Baltimore, Md	568	6.80	176	2.11
Birmingham, Ala	276	9.38	52	1.77
Boston, Mass	137	1.72	149	1.87
Chicago, Ill	1,316	3.59	774	2.11
Cincinnati, Ohio	148	3.13	127	2.69
Cleveland, Ohio	224	2.37	71	.75
Columbus, Ohio	64	2.04	26	.83

[1] No reports received from Buffalo, Kansas City, Milwaukee, New Orleans, Oakland, St. Louis, or Toledo.

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Reports from cities of 200,000 population or over—Continued

	Syphilis		Gonorrhea	
	Cases reported during month	Monthly case rates per 10,000 population	Cases reported during month	Monthly case rates per 10,000 population
Dallas, Tex	190	6 25	87	2.86
Dayton, Ohio	42	1.89	14	.63
Denver, Colo	66	2 19	35	1.16
Detroit, Mich	515	2 84	330	1.82
Houston, Tex	281	7.84	164	4.58
Indianapolis, Ind	21	54	26	.67
Jersey City, N. J	24	.74	8	.25
Los Angeles, Calif	472	3 10	344	2.26
Louisville, Ky	164	4 84	72	2.12
Memphis, Tenn	302	13 42	77	2 64
Minneapolis, Minn	50	1 00	65	1.30
Newark, N. J.	272	5 99	107	2.36
New York, N. Y	2,253	3 01	871	1.16
Omaha, Nebr	16	.72	28	1.25
Philadelphia, Pa	678	3 38	---	----------
Pittsburgh, Pa	209	2 97	27	.38
Portland, Oreg	65	2.03	64	2.00
Providence, R. I	38	1.46	37	1.43
Rochester, N. Y	48	1.40	39	1.14
St. Paul, Minn	38	1.32	24	.83
San Antonio, Tex	138	5.28	46	1.76
San Francisco, Calif	177	2.57	264	3.83
Seattle, Wash	83	2.14	96	2.48
Syracuse, N. Y.	91	4.04	8	.35
Washington, D. C	655	10.30	219	3.44

WEEKLY REPORTS FROM CITIES

City reports for week ended Jan. 13, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	193	1,137	144	2,250	1,008	1,710	35	368	20	1,128	--------
Current week [1]	103	1,027	61	843	713	1,186	1	321	9	720	--------
Maine:											
Portland	0	----	0	16	8	1	0	0	0	7	32
New Hampshire:											
Concord	0	-----	0	0	3	0	0	0	0	0	14
Manchester	0	-----	0	0	1	2	0	0	0	0	23
Nashua	0	------	0	8	0	0	0	0	0	0	5
Vermont:											
Barre	0	----	0	0	0	0	0	0	0	0	2
Burlington	0	------	0	0	0	0	0	0	0	4	10
Rutland	0	------	0	0	0	0	0	0	0	0	10
Massachusetts:											
Boston	2	------	0	21	22	34	0	5	1	53	269
Fall River	1	------	0	0	2	0	0	1	0	7	35
Springfield	0	------	0	1	5	2	0	0	0	4	44
Worcester	0	------	0	0	8	11	0	1	0	11	56
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	3	23
Providence	0	------	0	207	9	3	0	0	0	12	76
Connecticut:											
Bridgeport	0	------	0	0	5	2	0	1	0	0	39
Hartford	1	------	0	2	4	5	0	1	1	10	43
New Haven	0	2	0	1	4	2	0	1	0	10	67
New York:											
Buffalo	1	------	1	1	18	5	0	4	0	5	155
New York	18	13	3	12	93	211	0	69	2	86	1,562
Rochester	1	------	0	0	5	7	0	0	0	11	63
Syracuse	0	------	0	0	7	7	0	1	0	22	54

1 Figures for Terre Haute estimated; report not received.

City reports for week ended Jan. 13, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
New Jersey:											
Camden	0	1	1	0	4	11	0	0	0	0	29
Newark	0	5	0	2	3	10	0	3	0	17	99
Trenton	0	----	0	1	6	4	0	5	0	0	52
Pennsylvania:											
Philadelphia	1	5	4	9	38	69	0	21	0	40	598
Pittsburgh	4	6	5	1	24	32	0	4	0	11	214
Reading	0	----	0	1	3	1	0	0	0	8	40
Scranton	1	----	----	0	----	5	0	----	0	0	----
Ohio:											
Cincinnati	8	1	4	0	11	20	0	9	0	8	161
Cleveland	1	39	1	4	17	52	0	9	0	39	241
Columbus	1	1	1	0	9	4	0	3	0	3	111
Toledo	0	----	0	2	4	12	0	5	0	15	80
Indiana:											
Anderson	0	----	0	0	1	1	0	0	0	2	12
Fort Wayne	1	----	0	0	0	3	0	1	0	0	24
Indianapolis	0	----	2	1	15	27	0	5	0	5	115
Muncie	0	----	1	0	1	0	0	1	0	0	17
South Bend	0	----	0	0	0	1	0	0	0	3	13
Terre Haute	----	----	----	----	----	----	----	----	----	----	----
Illinois:											
Alton	1	----	0	0	1	3	0	0	0	0	8
Chicago	12	19	3	10	51	226	0	30	0	40	797
Elgin	0	----	0	0	0	1	0	0	0	1	7
Moline	1	----	0	0	0	1	0	0	0	0	11
Springfield	0	----	1	0	3	4	0	0	0	2	20
Michigan:											
Detroit	2	4	1	13	23	82	0	8	0	26	292
Flint	0	----	0	0	6	15	0	0	0	7	34
Grand Rapids	0	----	0	1	5	9	0	0	0	5	41
Wisconsin:											
Kenosha	0	----	0	0	0	0	0	0	0	4	12
Madison	0	----	0	0	2	1	0	0	0	4	18
Milwaukee	0	----	0	0	12	30	0	3	0	8	134
Racine	0	----	0	1	1	0	0	0	0	1	19
Superior	0	----	0	1	0	3	0	0	0	0	13
Minnesota:											
Duluth	0	----	0	168	1	3	0	0	0	0	22
Minneapolis	1	----	0	1	4	23	0	1	1	12	98
St. Paul	0	----	0	2	6	18	0	1	0	33	69
Iowa:											
Cedar Rapids	0	----	----	11	----	2	0	----	0	0	----
Davenport	0	----	----	1	----	2	0	----	0	0	----
Des Moines	0	----	0	18	0	16	1	0	0	0	40
Sioux City	0	----	----	0	----	0	0	----	0	0	----
Waterloo	0	----	----	1	----	6	0	----	0	0	----
Missouri:											
Kansas City	0	----	0	6	11	13	0	1	1	2	94
St. Joseph	0	----	0	0	2	1	0	0	0	0	27
St. Louis	7	----	0	3	17	19	0	3	1	6	218
North Dakota:											
Fargo	0	----	0	0	2	6	0	0	0	0	10
Grand Forks	0	----	----	0	----	0	0	----	0	5	----
Minot	0	----	0	1	0	1	0	0	0	0	3
South Dakota:											
Aberdeen	0	----	----	0	----	1	0	----	0	0	----
Sioux Falls	0	----	0	0	0	0	0	0	0	0	7
Nebraska:											
Omaha	2	----	0	1	9	3	0	2	1	1	76
Kansas:											
Lawrence	0	10	0	1	1	0	0	0	0	1	5
Topeka	1	----	0	0	3	0	0	0	0	0	11
Wichita	3	----	0	71	5	8	0	0	0	2	35
Delaware:											
Wilmington	0	----	0	0	3	3	0	0	0	2	30
Maryland:											
Baltimore	3	21	1	1	22	8	0	9	0	76	301
Cumberland	0	----	0	0	1	4	0	1	0	0	15
Frederick	0	----	0	0	0	0	0	0	0	0	4
District of Columbia:											
Washington	3	11	1	0	11	13	0	5	0	5	185
Virginia:											
Lynchburg	0	----	0	0	2	0	0	0	0	1	11
Norfolk	1	23	0	0	1	0	0	2	0	0	25
Richmond	0	----	3	2	7	5	0	1	0	0	60
Roanoke	0	----	0	1	0	3	0	1	0	0	17

City reports for week ended Jan. 13, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
West Virginia:											
Charleston	0		0	0	8	0	0	0	0	0	30
Huntington	2	---		0		0	0		0	0	-----
Wheeling	0		0	0	3	2	0	0	1	0	21
North Carolina:											
Gastonia	0	2	-	2	-	1	0		0	0	-------
Raleigh	0	---	0	0	1	4	0	0	0	0	13
Wilmington	1	--	0	0	0	0	0	0	0	0	11
Winston-Salem	0	1	0	0	2	0	0	2	0	1	19
South Carolina:											
Charleston	3	378	2	0	2	1	0	3	0	0	31
Florence	0	3	1	0	5	0	0	0	0	0	15
Greenville	0	-----	1	0	2	0	0	0	0	0	16
Georgia:											
Atlanta	1	231	7	11	10	11	0	4	0	1	90
Brunswick	0	----	0	0	1	1	0	0	0	0	4
Savannah	1	134	8	0	5	3	0	0	0	0	39
Florida:											
Miami	0	6	0	2	2	2	0	1	0	0	46
Tampa	1	1	1	2	2	3	0	3	0	0	37
Kentucky:											
Ashland	0	6	0	0	0	2	0	0	0	8	5
Covington	0	------	0	0	2	2	0	1	0	0	17
Lexington	0	------	0	0	3	2	0	1	0	0	17
Louisville	3	3	0	2	7	5	0	4	0	34	85
Tennessee:											
Knoxville	1	25	1	0	3	8	0	2	0	0	27
Memphis	0	------	1	3	10	15	0	2	0	5	93
Nashville	0	---	0	2	14	4	0	0	0	4	---
Alabama:											
Birmingham	0	43	2	3	6	5	0	6	0	1	75
Mobile	1	1	1	1	1	2	0	2	0	0	31
Montgomery	0	12	--------	12	---	1	0	-----	0	0	-----
Arkansas:											
Fort Smith	2	9	----	0	----	0	0	-	0	0	-----
Little Rock	0	4	0	0	8	0	0	3	0	0	36
Louisiana:											
Lake Charles	0	---	0	1	1	1	0	1	0	0	4
New Orleans	2	19	0	1	24	10	0	13	0	1	193
Shreveport	0	-----	0	0	10	1	0	1	0	3	41
Oklahoma:											
Oklahoma City	0	6	1	0	4	3	0	1	0	0	31
Tulsa	0	-----	-----	0	------	0	0	------	0	4	-----
Texas:											
Dallas	6	3	3	0	7	9	0	4	0	5	72
Fort Worth	0	----	0	0	5	1	0	0	0	10	42
Galveston	0	------	0	0	2	3	0	1	0	0	22
Houston	1	----	0	0	11	0	0	6	0	3	81
San Antonio	0	5	0	51	0	3	0	23	0	0	97
Montana:											
Billings	0	-----	1	0	0	1	0	0	0	0	6
Great Falls	0	----	0	0	0	2	0	0	0	0	4
Helena	0	-----	0	1	0	1	0	0	0	0	2
Missoula	0	------	0	0	0	2	0	0	0	0	5
Idaho:											
Boise	0	------	0	0	4	1	0	0	0	0	6
Colorado:											
Colorado Springs	0	------	0	0	0	0	0	0	0	0	10
Denver	6	------	0	3	13	5	0	0	0	5	81
Pueblo	2	------	0	3	7	3	0	0	0	0	10
New Mexico:											
Albuquerque	0	------	0	0	1	3	0	1	0	7	17
Utah:											
Salt Lake City	0	------	2	31	2	5	1	2	0	45	44
Washington:											
Seattle	0	------	0	40	8	12	0	5	0	7	103
Spokane	0	------	0	0	5	1	0	0	0	2	31
Tacoma	0	------	0	111	1	5	0	0	0	0	38
Oregon:											
Portland	0	31	0	13	1	5	0	1	0	3	82
Salem	0	------	--------	8	-------	0	0	------	0	0	--------
California:											
Los Angeles	0	76	1	13	10	27	0	20	0	9	458
Sacramento	3	1	0	2	1	1	0	3	0	0	38
San Francisco	1	2	0	3	8	14	0	8	0	23	189

City reports for week ended Jan. 13, 1940—Continued

State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Polio-myelitis cases	State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Polio-myelitis cases
Massachusetts:				Missouri:			
Boston	1	0	0	St. Joseph	0	1	0
Rhode Island:				District of Columbia:			
Pawtucket	1	0	0	Washington	1	0	0
New York				Kentucky:			
New York	0	0	1	Ashland	0	0	1
Pennsylvania:				Texas:			
Pittsburgh	2	0	0	Galveston	0	0	1
Ohio:				San Antonio	1	0	0
Toledo	1	0	0	Washington:			
Indiana:				Seattle	1	0	0
Indianapolis	1	1	0	California:			
Michigan:				Los Angeles	0	0	2
Detroit	0	0	1				

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Grand Rapids, 1; Kansas City, 1.
Pellagra.—Cases: Dallas, 1.
Typhus fever.—Cases: Kansas City, 1; Charleston, S. C., 1; Savannah, 3; Tampa, 1; Lake Charles, 1.

FOREIGN REPORTS

CUBA

Habana—Communicable diseases—4 weeks ended December 16, 1939.—During the 4 weeks ended December 16, 1939, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	15	1	Tuberculosis	7	1
Malaria	7	1	Typhoid fever	43	5
Scarlet fever	1				

Provinces—Notifiable diseases—4 weeks ended December 9, 1939.—During the 4 weeks ended December 9, 1939, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	2	1	1	3		8	15
Chickenpox				1			1
Diphtheria		12	2	2	1	1	18
Leprosy		1	1			3	5
Malaria	16	17	1	14	9	58	115
Measles						2	2
Poliomyelitis	1			1			2
Scarlet fever		3					3
Tuberculosis	14	25	7	25	15	30	116
Typhoid fever	18	39	4	28	6	29	124
Yaws						1	1

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of January 26, 1940, pages 182-186. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Thailand.—A report dated January 19, 1940, states that an outbreak of plague has occurred in northern Thailand, where 46 cases with 13 deaths have been reported up to January 13, 1940.

Typhus Fever

France—Basses-Alpes Department—Le Caire.—During the week ended January 13, 1940, 1 case of typhus fever was reported in Le Caire, Basses-Alpes Department, France.

Yellow Fever

Brazil—Espirito Santo State—Domingos Martins.—On December 29, 1939, 2 deaths from the jungle type of yellow fever were reported in Domingos Martins, Espirito Santo State, Brazil.

French Equatorial Africa—Fort Archambault.—On January 12, 1940, 1 case of yellow fever and 1 suspected case of the same disease were reported in Fort Archambault, French Equatorial Africa.

Public Health Reports

VOLUME 55 FEBRUARY 9, 1940 NUMBER 6

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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CONTENTS

Public Health Reports

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TULARAEMIA INFECTION FOUND IN STREAMS

Doctors Parker, Jellison, Kohls, and Davis of the Rocky Mountain Laboratory of the Public Health Service at Hamilton, Mont., have reported that water in three Montana streams has been found contaminated with *Bacterium tularense*. Two of these streams are flowing creeks. From one of these, 5- and 10-cc. samples produced characteristic tularaemia infection in guinea pigs. From the other, infection was recovered from two 10-cc. samples. The third stream is a small river which at this time of year normally consists of a succession of large pools. Three successive samples taken over a period of 28 days from one of these pools have all shown contamination, and guinea pigs receiving the following amounts have become infected: Two that received 1 cc., two that received 2½ cc. each, six that received 5 cc. each, and one that received 10 cc. In addition, two guinea pigs that received a small amount of mud from this same pool became infected. A 10-cc. sample from another pool several miles distant was also positive. These findings were made incident to studies of epizootic tularaemia in beaver.

THE DISABLING DISEASES OF CHILDHOOD*

Their Characteristics and Medical Care as Observed in 500,000 Children in 83 Cities Canvassed in the National Health Survey, 1935–1936

II. MEDICAL AND NURSING CARE[1]

By Dorothy F. Holland, *Statistician, United States Public Health Service*

The characteristic diseases of childhood are infectious in nature. Supervision of water supplies, sanitary disposal of sewage, and pasteurization of milk contribute to the control of certain of these diseases. By and large, however, the contact-borne infections present the major problem in the control of communicable disease today; and, by establishing the diagnosis and reporting the case, the physi-

* From the Division of Public Health Methods, Section on Medical Care Studies, National Institute of Health.

[1] The first report in this series describes the characteristics and leading causes of disabling illness in childhood. Holland, Dorothy F.: The disabling diseases of childhood. Their characteristics and medical care as observed in 500,000 children canvassed in the National Health Survey, 1935–1936. I. Characteristics and leading causes. Pub. Health Rep., 55: 135–156 (1940).

cian takes the first step toward an effective program of prevention. Protection from certain communicable diseases may be secured by the creation of artificial immunity. Periodic medical supervision of well children is a valuable measure for the general promotion of child health. However essential, the development of these preventive health services must not be permitted to obscure the importance of medical care of the sick child as a means of protecting both the sick and the well.

Medical care of the sick child fills the important function of promoting recovery and reducing the incidence of sequelae which immediately or ultimately impair health. On the average, a high recovery rate is characteristic of the diseases of childhood, except in the period of infancy; but deaths of older children from causes to some degree preventable are by no means negligible. In the 3-year period 1933–35, an average of 51 percent of all deaths of children between 1 and 15 years of age were due to the infectious and parasitic diseases, pneumonia, and diarrhea and enteritis. In this period, an annual average of 23,000 deaths of children of these ages were caused by diseases in the infectious and parasitic group, 10,746 by all forms of pneumonia, and 5,458 by diarrhea and enteritis. These deaths measure in part the result of lack of medical care and of delay in summoning medical aid beyond the point at which treatment is effective.

The records obtained in the National Health Survey provide the basis for a general view of the medical and nursing care of disabling illness received in a 12-month period by over 500,000 children in 83 urban communities. The canvass was made in large, medium-sized, and small cities, and the results thus permit an examination of the effect of urbanization on the amount and nature of medical services for the disabling diseases of children. The records relating to annual family income and relief status in the survey year make possible the comparison of the medical care experience of children in different economic groups. The results of the survey analyzed from this standpoint have a practical bearing on certain broad problems involved in the maintenance of child health.

METHOD OF THE SURVEY

The present report is based on the records of medical and nursing care received for disabling illness in a 12-month period by 518,767 white children under 15 years of age in 83 cities canvassed by the United States Public Health Service in the winter of 1935–36. The 83 surveyed cities [2] were located in 18 States selected in such a manner as to give adequate representation to each geographic area, but the

[2] A list of the surveyed cities is given in Appendix B of "The National Health Survey: Scope and method of the Nation-wide family canvass of sickness in relation to its social and economic setting," by George St. J. Perrott, Clark Tibbitts, and Rollo H. Britten. Pub. Health Rep., 54: 1663 (1939).

sample is somewhat overweighted with families drawn from cities of 100,000 population and over.[3] Internal representativeness of the surveyed population was obtained by making a complete canvass of 51 cities of less than 100,000 population, and sampling [4] the households of 31 cities of 100,000 population and over, and 1 city of the former population class.

The survey employed the method of the house-to-house canvass, the information concerning the social and economic characteristics of the family and its records of illness and medical and nursing care in a 12-month period being obtained by the enumerator from a lay informant, usually the housewife.[5]

"Illness" [6] was defined as a disease, injury, or permanent gross impairment, congenital or acquired, which had caused disability for at least 7 consecutive days in a 12-month period falling approximately in the year 1935. In the period of childhood, disability was used in the sense of interference with normal activity, i. e., play of the preschool child or school attendance of older children. The medical and nursing services in the present report relate to care of disabling illnesses of this category, with the exception of hospitalized illnesses, which include cases unlimited as to duration. Confirmation of the informant's statement of the cause of illness was requested from the attending physician for cases so attended, but the majority of the medical causes of illness are those assigned by the lay informant. The records of medical and nursing care take into account the services received for an entire illness irrespective of the number of diagnoses assigned as causes of the illness. In the present report, however, the classification of illnesses by cause according to specific or broad diagnosis is made on the basis of the sole or primary cause of the illness.

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[3] The distribution of the surveyed urban population by geographic area agrees closely with that of the total urban population as enumerated in the Federal Census of 1930. The distribution by population class of the city of residence is necessarily somewhat less representative, 74 percent of the surveyed population being drawn from cities of 100,000 and over as compared with 52 percent for the total urban population in 1930. For the cities of 25,000 to 100,000 population, the corresponding figures were: Health Survey, 14 percent; Census of 1930, 19 percent; and for cities of less than 25,000 population: Health Survey, 12 percent; Census of 1930, 29 percent. The scope of the survey permitted only a limited sampling of rural areas in 3 States.

[4] The sampling procedure consisted of a random selection of districts to be canvassed within each city, the districts used being those outlined for the enumeration of the population in the Federal Census of 1930. Districts containing approximately equivalent units of population were obtained by arbitrary division of the Census enumeration districts having a population in excess of 1,000. The number of such districts to be surveyed was determined by the number of surveyed families required to give a sample adequately representing the given city, and sufficient to produce an urban sample representative of all regions of the country, and, within the limitations of the survey, balanced in respect to size of the cities included. A complete canvass was made of the districts selected in this manner. For a complete description of the sampling procedure, see the publication referred to in footnote 2.

[5] A reproduction of the survey schedule is included in the publication referred to in footnote 2.

[6] Certain exceptions to this definition were made. Records of all confinements, hospital cases, and deaths were taken without limitation as to the duration of disability. An additional exception was made in the enumeration of chronic diseases and permanent gross impairments, which were recorded without limitation as to the duration of disability. Chronic diseases or permanent impairments which caused no disability or disability of less than 7 consecutive days' duration are not considered in the present report.

Age variation in the receipt of medical care.—The illnesses of childhood, except in the period of infancy, are characterized by a shorter mean duration and a higher recovery rate than those of adult life. It may be expected, therefore, that children and adults will differ in respect to the proportion of illnesses receiving medical and nursing care, and the intensity of care received per patient attended. The experience of white persons in 83 cities canvassed in the survey is examined from this standpoint in table 1. Since the number of physicians and nurses, and the facilities of hospitals and their associated out-patient departments tend to vary with the degree of urbanization, the data are presented for the surveyed population in three groups of cities classified by size. Figure 1 shows the results graphically for the large and small surveyed cities only.

Columns 1 and 5 of the table relate to medical attendance of disabling illness by a physician in the home, clinic, or physician's office, but exclude cases receiving only hospital medical care. Furthermore, illnesses receiving care from a physician in the home, office, or clinic in addition to hospital care are counted both as "physician's" and "hospital" cases, but the consultations with a physician received by such cases exclude those received during hospitalization. Columns 2 and 6, designated "hospital—general," represent an approximation of general hospital patients and patient days obtained by excluding all hospitalized cases of tuberculosis and cases of nervous and mental disease or defect which had received institutional care for at least a year; it was assumed that the majority of such cases were hospitalized in special institutions. However, new admissions to hospitals for the mentally diseased during the survey year could not be segregated on the basis of data recorded in the survey, and these cases are, therefore, included in the "general" hospital group. In the interpretation of the data relating to hospital care, it should be noted that the survey enumerators sought information concerning all cases receiving hospital care, without restriction as to the period of disability; it is believed, however, that hospital cases disabled for less than a week were incompletely enumerated.

Reference to the table indicates that the proportion of the disabling illnesses of children under 15 years of age receiving care from a physician was, in general, lower than the proportion of attended illnesses among adults in each group of surveyed cities. In the large cities, the age variation was not marked; in the small cities under 25,000 population, the proportion of children's illnesses receiving home, office, or clinic medical care was notably lower than among adults. The proportion of children's illnesses receiving general hospital care was approximately the same as in old age, but was lower in

both of these periods than among adults between 15 and 65 years of age. This period of adult life includes the child-bearing ages, in which hospital care of women for conditions associated with the puerperal state is frequent. At each age period, the proportion of hospitalized illnesses was lower in the cities under 25,000 population than in the large cities, but the difference was most marked among children and the aged.

TABLE 1.—*Age variation in the receipt of medical and nursing care of disabling [1] illness in a 12-month period, in surveyed cities of three population classes—2,152,740 white persons [2] in 83 cities canvassed in 1935–36*

Age period (years)	Percentage of disabling [1] illnesses receiving specified care				Services per disabling [1] illness receiving specified care				Number of disabling [1] illnesses
	Medical		Bedside nursing		Medical		Bedside nursing		
	Physician	Hospital—general [3]	Private duty nurse [5]	Visiting nurse	Physician	Hospital—general [3]	Private duty nurse [5]	Visiting nurse	
	Cities of 100,000 and over								
All ages [2]	71.0	30.2	3.4	7.7	7.5	19.2	28.7	5.2	253,581
Under 15	68.1	19.5	1.2	13.9	4.3	15.3	18.7	3.2	79,053
15–24	68.5	41.1	2.9	7.0	6.4	15.2	13.3	5.8	32,519
25–64	72.9	[4] 35.7	4.3	4.6	9.0	[4] 20.6	23.9	8.0	118,715
65 and over	74.9	19.7	6.7	3.0	11.0	32.6	60.1	14.0	23,264
	Cities of 25,000–100,000								
All ages [2]	72.1	23.1	4.8	4.7	7.4	16.2	21.2	6.5	55,990
Under 15	63.9	12.5	1.7	6.2	4.6	11.6	10.8	3.8	17,252
15–24	73.7	32.8	4.5	5.1	6.3	12.6	11.9	5.1	7,925
25–64	76.6	[4] 29.2	6.3	3.8	8.7	[4] 17.4	18.3	8.0	25,223
65 and over	74.9	14.7	7.8	3.6	10.5	28.2	46.2	15.7	5,590
	Cities under 25,000								
All ages [2]	68.7	18.9	4.4	6.0	7.1	16.7	23.3	5.2	59,431
Under 15	57.6	8.8	1.4	9.2	4.3	11.1	11.3	2.9	20,193
15–24	70.5	27.7	4.7	6.0	6.1	12.5	9.5	4.9	8,744
25–64	75.3	[4] 25.7	5.9	4.0	8.5	[4] 18.5	20.1	8.2	24,374
65 and over	75.9	13.1	8.1	3.2	10.2	28.4	50.5	12.2	6,120

[1] Disabling for 7 consecutive days or longer in a 12-month period. All confinements, fatal, and hospital cases are included without reference to the duration of disability. Illness as used here is a continuous period of disability whether due to a single cause or multiple causes.
[2] Exclusive of persons of unknown age or unknown income.
[3] Cases receiving hospital care are exclusive of all hospitalized cases of tuberculosis, and cases of nervous and mental disease or defect in institutions for 12 months. These exclusions leave a group of hospital cases which roughly approximates patients treated in general and special hospitals, exclusive of hospitals for the tuberculous and the mentally diseased. Since the type of institution in which care was received was not recorded in the survey, a more exact definition of general hospital patients is not possible.
[4] Excluding also hospitalized confinements terminating in live births, the proportion of disabling illnesses hospitalized was as follows: Cities of 100,000 and over, ages 15–24, 35.7 percent, ages 25–64, 30.7 percent; cities of 25,000 to 100,000, ages 15–24, 28.0 percent, ages 25–64, 25.9 percent; cities under 25,000, ages 15–24, 24.7 percent, ages 25–64, 23.2 percent. The corresponding average hospital-patient days were as follows: 17.9 (ages 15–24), 23.7 (ages 25–64) in cities of the first class; 14.9 (ages 15–24), 19.6 (ages 25–64) in cities of the second class; 13.8 (ages 15–24), 20.4 (ages 25–64) in cities of the third class.
[5] Includes attendance in home or hospital.

In each group of cities, the illnesses of children receiving medical care were given less intensive care than the attended illnesses of adults. Among children under 15 years of age, the average attended

case of disabling illness had approximately 4 consultations with a physician, exclusive of hospital visits; in youth, the average was 6 consultations; in the adult ages between 25 and 65, approximately 9; and in old age, between 10 and 11 consultations.

The average length of stay in the hospital per child patient in the large cities was 15.3 days; among adults 25 to 64 years of age, 20.6 days; and among the aged, 32.6 days; in youth, the average number of hospital patient days was approximately the same as in childhood. In the cities under 25,000 population, the average hospital duration

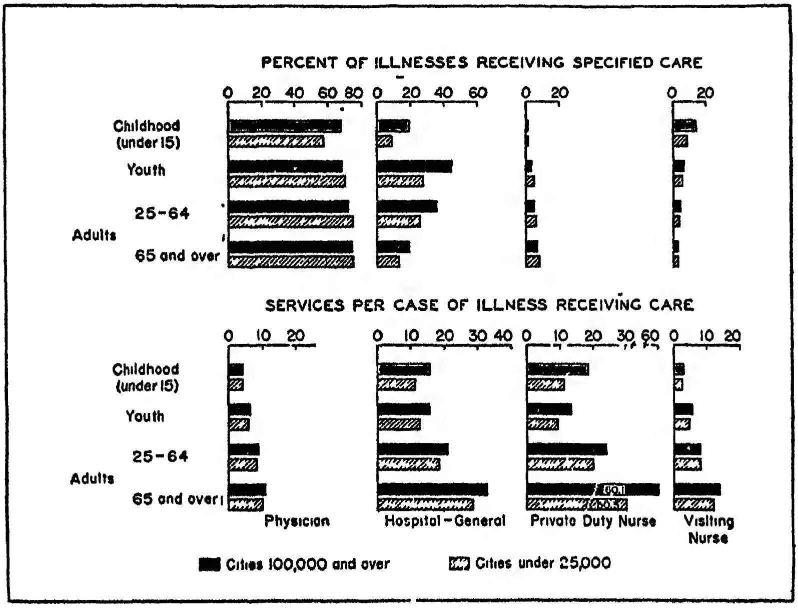

FIGURE 1.- Percentage of disabling illnesses occurring in a 12 month period which received medical and nursing care, and services per disabling illness receiving care, by age 1,581,577 persons in 31 cities of 100,000 population and over, and 267,053 persons in 42 cities under 25,000 population canvassed in 1935 36. Cases of illness receiving hospital care are exclusive of all hospitalized cases of tuberculosis, and cases of mental and nervous disease in institutions for 12 months.

was somewhat lower at each age period than in the large cities, but the relative variation by age was of the same nature. In general, the average length of stay in the hospital observed in the survey exceeds the average for general hospitals as usually reported. The lack of agreement arises from the fact that the survey cases designated "general" hospital patients include the residual group of the mentally diseased admitted to special institutions during the survey year, and exclude certain hospital cases disabled for less than a week which were incompletely enumerated.

The low average intensity of medical care given to children's illnesses results from the fact that the majority of child patients are

treated for diseases of low severity and a favorable prognosis. As age increases, the severity of illness increases, and medical care is required in correspondingly greater amount.

In comparison with illnesses attended by a physician, the proportion of illnesses receiving bedside nursing care was relatively low at each age period. The visiting nurse was used more frequently than the private duty nurse for bedside nursing care of the illnesses of children; with increasing age, there was, in general, an increasingly higher proportion of illnesses cared for by a private duty nurse, and a decrease in the proportion of illnesses attended by a visiting nurse. The amount of bedside nursing care received, measured as days of care by the private duty nurse or visits of the visiting nurse, was, in general, lower among children than among adults, exclusive of the period of youth.

Income and medical care of childhood illness.—While the illnesses of childhood received, on the average, less medical care than those of adults, measured both in terms of the proportion of illnesses treated and the amount of care per patient, it was found that the experience of children in families at different income levels showed a wide departure from the average. This relationship is shown in table 2, in which the results are again presented separately for children in three groups of surveyed cities classified by size.

Care was given by a physician (exclusive of hospital medical care) in 80 percent of the disabling illnesses of children in families with an income of $3,000 and over in the large surveyed cities; in relief families in these cities, only 65 percent of the illnesses of children received "home or office" medical care. With decreasing urbanization, represented by the intermediate and small surveyed cities, the proportion of childhood illnesses receiving care from a physician was lower than in the large cities at each income level, but the relative difference between the lowest and highest income groups was of the same order as in the large cities.[7] A similar association between income and the intensity of care received from a physician was observed. In families with an income of $3,000 and over, each child patient received, on the average, about 5 consultations with a physician in the home, clinic, or physician's office; in relief families, the average was about 4 consultations.

Further examination of the data in table 2 indicates that the proportion of children's illnesses attended by a physician (exclusive of hospital treatment), and the intensity of such care, was approximately the same in self-sustaining families with income below $1,000 as in fami-

[7] In the rural areas of 16 counties canvassed in Georgia, the proportion of the disabling illnesses of Negro children receiving care from a physician was notably low. Only 39 percent of 680 disabling illnesses recorded among Negro children under 15 years of age received care from a physician, exclusive of hospital medical care; among white children, the comparable figure was 64 percent (1,479 disabling illnesses being recorded). The results of the survey of children in rural areas will form the subject of another report in this series.

lies on relief; and at the next income level (income between $1,000 and $2,000), the amount of care did not greatly exceed that in the two lowest income groups. In this survey the proportion of all disabling illnesses of children under 15 years of age occurring in families below the $2,000 income level ranged from 82 percent in the large cities to 87 percent in the cities under 25,000 population. Thus, the majority of

TABLE 2.—*Variation in the receipt of medical and nursing care of disabling [1] illness in childhood according to income in a 12-month period, in surveyed cities of three population classes—518,767 white children [2] under 15 years of age in 83 cities canvassed in 1935–36*

Income class	Percentage of disabling [1] illnesses receiving specified care				Services per disabling [1] illness receiving specified care				Percentage distribution of disabling [1] illnesses by income
	Medical		Bedside nursing		Medical		Bedside nursing		
	Physician	Hospital—general [3]	Private duty nurse [4]	Visiting nurse	Physician	Hospital—general [3]	Private duty nurse [4]	Visiting nurse	
	Cities of 100,000 and over								
All incomes [2]	68.1	19.5	1.2	13.9	4.3	15.3	18.7	3.2	100.0
Relief	65.1	24.3	.4	19.5	3.9	19.6	20.2	3.7	27.2
Nonrelief:									
Under $1,000	63.0	19.6	.6	13.5	4.3	15.9	15.2	3.2	15.8
$1,000–$2,000	68.4	17.5	1.1	12.3	4.3	13.4	19.3	2.7	39.1
$2,000–$3,000	74.5	16.7	2.1	10.5	4.6	9.5	17.9	2.8	11.7
$3,000 and over	80.2	16.1	5.8	7.7	5.4	9.8	19.0	2.5	6.3
	Cities of 25,000–100,000								
All incomes [2]	63.9	12.5	1.7	6.2	4.6	11.6	10.8	3.8	100.0
Relief	60.9	14.9	.4	10.3	4.1	14.0	5.8	3.6	26.1
Nonrelief:									
Under $1,000	60.3	10.9	.8	5.4	4.4	12.1	10.4	4.5	21.7
$1,000–$2,000	64.2	11.4	1.6	5.0	5.0	10.3	11.1	4.1	36.9
$2,000–$3,000	71.2	12.9	3.1	3.8	4.7	9.8	12.5	2.0	9.7
$3,000 and over	76.7	13.3	8.9	1.8	5.5	7.9	10.8	4.2	5.6
	Cities under 25,000								
All incomes [2]	57.6	8.8	1.4	9.2	4.3	11.1	11.3	2.9	100.0
Relief	52.6	7.8	.5	13.4	3.9	17.1	6.0	3.1	25.0
Nonrelief:									
Under $1,000	54.0	8.2	1.0	9.0	4.3	12.3	10.4	2.8	24.6
$1,000–$2,000	59.7	9.2	1.4	8.3	4.4	8.7	9.8	2.8	36.3
$2,000–$3,000	66.5	10.4	3.2	4.5	4.7	7.5	14.6	2.6	9.3
$3,000 and over	71.6	11.8	3.6	4.6	5.1	4.5	15.7	1.4	4.2

[1] See footnote 1, table 1.
[2] Exclusive of children of these ages in families for which income was reported as unknown.
[3] See footnote 3, table 1.
[4] See footnote 5, table 1.

childhood illnesses occurred in the economic groups in which the proportion of cases receiving care from a physician, and the amount of care per case, was relatively low. In this connection it should be recalled that the illnesses of children considered here had caused disability of at least a week's duration, and medical supervision may be assumed to be necessary for the majority of such cases.

In the small surveyed cities, the proportion of the illnesses of children receiving medical care in the hospital was lowest in relief families, and increased progressively as family income increased. In the large cities, however, this association was reversed, the proportion of the illnesses of children which were hospitalized being highest in relief families, and decreasing as family income increased. This situation reflects the greater demand for hospital care resulting from the congested housing conditions of low income families in the large cities, and the more abundant supply of free hospital facilities by which this demand can be met. The relation will be further clarified in the discussion of the data shown in table 3.

The association between family income and the type of nurse employed for bedside nursing care of the sick, i. e., private duty or visiting nurse, reflects the method of meeting the costs of these services. The bedside nursing care given by visiting nurses is provided largely without cost to the patient, while the costs of private duty care are met from private income. The relation observed in this survey between family income and the receipt of bedside nursing care for the illnesses of children was consistent with these facts. A relatively high proportion of children's cases in low income families received care from a visiting nurse, while the proportion of cases in these families cared for by a private duty nurse was negligible. The essential question presents itself: Does the bedside nursing care provided by visiting nurses for the illnesses of children in low income families meet their needs as adequately as the care given by the private duty nurse? The question is raised since such a consideration should underlie the interpretation of the relation observed between economic status and the type of bedside nursing care received. Data bearing on the question are, however, beyond the scope of the present survey.

Additional factors of importance in analyzing the association between economic status and hospital care are considered in table 3, in which the hospital cases of children are classified in two broad groups according to the type of treatment received, i. e., medical and surgical. The figures in this table indicate that the proportion of children who became hospital patients during the survey year (as distinguished from the proportion of illnesses which were hospitalized) was notably higher in the large cities than in the intermediate and small cities. This excess is not the result of a higher incidence of illness (since the frequency rate of illness was found to be lowest in the large cities [8]), but is due, in part, to a relatively higher frequency of medical hospital cases. Among children under 15 years of age, the frequency rate of medical hospital cases in the large cities was 15 per 1,000; in the small cities it was about 7 per 1,000. On the other hand, the frequency of

[8] See article referred to in footnote 1.

surgical hospital cases showed relatively smaller variation, the frequency rate in the large cities being 27 per 1,000 children under 15 years, and in the small cities 20 per 1,000.

It is notable, furthermore, that the frequency rate of medical hospital cases in the large cities decreased consistently with rise in income, while the frequency of surgical hospital cases increased with increasing

ABLE 3.—*Frequency rate in a 12-month period of hospital cases*[1] *classified as medical and surgical, and of nonhospitalized surgical cases, according to income, among children in surveyed cities of three population classes—518,767 white children*[2] *under 15 years of age in 83 cities canvassed in 1935–36*

Income class	Cases per 1,000 persons under 15				
	Hospital			Surgical, treated in home, clinic, or physician's office[3]	Surgical, total hospital and non-hospital
	Total	Medical	Surgical		
	Cities of 100,000 and over				
All incomes[2]	41.7	14.9	26.7	10.0	36.7
Relief	59.5	26.9	32.6	7.9	40.5
Nonrelief:					
Under $1,000	37.8	14.9	22.9	9.4	32.3
$1,000-$2,000	34.8	10.7	24.1	10.2	34.3
$2,000-$3,000	36.9	8.8	28.1	13.5	41.5
$3,000 and over	39.0	7.6	31.4	11.6	42.9
	Cities of 25,000-100,000				
All incomes[2]	27.8	8.7	19.1	12.7	31.7
Relief	36.2	14.1	22.1	9.7	31.8
Nonrelief:					
Under $1,000	21.6	7.7	13.9	10.9	24.8
$1,000-$2,000	24.5	6.1	18.4	14.2	32.6
$2,000-$3,000	31.6	6.5	25.1	14.7	39.9
$3,000 and over	36.2	10.8	25.5	20.7	46.1
	Cities under 25,000				
All incomes[2]	26.9	6.5	20.4	12.4	32.8
Relief	26.2	7.6	18.6	13.1	31.7
Nonrelief:					
Under $1,000	22.3	3.3	17.0	9.4	26.5
$1,000-$2,000	27.8	6.6	21.2	12.5	33.7
$2,000-$3,000	33.3	5.5	27.9	17.4	45.3
$3,000 and over	41.5	10.3	31.2	17.7	48.9

[1] Includes (1) cases in which the hospitalized illness or injury was the sole cause of disability; (2) cases in which multiple causes were assigned to the illness, and hospital care was received for the primary, or any contributory, cause of the illness. In enumerating hospital cases, no limitation was imposed concerning the duration of the disability.
[2] Exclusive of children of these ages in families for which income was reported as unknown.
[3] Includes only illness disabling for 7 consecutive days or longer in the survey year which received surgical treatment as specified.

income, if the rate for children in relief families be excepted. The association between income and the frequency of surgical cases treated outside the hospital was likewise direct, the lowest rate being observed in the lowest income group, with a progressive increase in succeeding income classes.

It appears, then, that low income families in the large cities tend to hospitalize certain medical cases of children which families in the

higher income groups care for at home. The higher frequency rates of these cases in the low income groups do not imply that care of these cases is more adequate among the poor, but indicate only that a higher proportion of medical cases are treated outside the home.

MEDICAL AND NURSING CARE OF THE DISEASES OF CHILDREN CLASSIFIED BY CAUSE [9]

Diseases of children treated by the physician and nurse.—The diseases of children which predominate among the child patients of the physician and nurse may be illustrated by the records of children in the large surveyed cities, shown in table 4; the experience of children in the intermediate and small cities shows no essential differences, and is therefore omitted.

The combined frequency rate of disabling illness due to the communicable diseases, tonsillitis, and other minor respiratory diseases among surveyed children in these large cities represented 75 percent of the rate for all causes of illness in a 12-month period. It is thus consistent with the high incidence of these diseases that they were most frequent among children's illnesses treated by a physician, accounting for 71 percent of the physicians' child patients. Illnesses due to these causes, however, absorbed only 54 percent of the physicians' services for children. On the other hand, the less frequent cases of pneumonia, the major chronic diseases, orthopedic impairments, and accidental injury together represented only 15 percent of the physicians' child patients, but absorbed 28 percent of their services for children. Illnesses due to causes included in the latter group are relatively severe and require intensive medical supervision. Reference to the figures shown in table 6 (page 242) indicates that the average case of pneumonia among children under 15 years of age in the large surveyed cities received 8.9 consultations with a physician; for rheumatism, the average was 10.1 consultations; for orthopedic

[9] For the purpose of a broad classification of the causes of disabling illness in childhood, four groups of diseases having certain common characteristics have been used. By excluding influenza, tuberculosis, and specific infections of the intestinal tract from the specific infectious diseases, a new *communicable* group has been established which comprises mainly the common communicable diseases of childhood: measles, mumps, chickenpox, whooping cough, scarlet fever, and diphtheria. Influenza has been combined with the diseases of the nose, throat, and lungs (except respiratory tuberculosis) to form the *respiratory* group which, in childhood, includes largely acute diseases: tonsillitis, colds, pneumonia, and bronchitis, in addition to influenza. The specific infectious diseases of the intestinal tract have been combined with other diseases of the digestive system to form the *digestive* group, which includes appendicitis, indigestion, biliousness, diarrhea and enteritis, ulcer of the stomach or duodenum, and diseases of the gall bladder or liver. Finally, tuberculosis, all forms; nervous and mental disease or defect; cancer; rheumatism; diabetes; cerebral hemorrhage and other forms of paralysis; diseases of the heart, arteriosclerosis and high blood pressure, and other diseases of the circulatory system, exclusive of hemorrhoids and varicose veins; and nephritis and other nonvenereal diseases of the genitourinary system, exclusive of circumcision and diseases of the female genital organs, have been combined under the group of major chronic diseases. By definition, certain chronic diseases of the respiratory and digestive systems are included, respectively, in the respiratory and digestive groups; however, the incidence of these chronic diseases is relatively low in childhood, and among children under 15 years of age the respiratory and digestive groups of diseases as used here comprise chiefly acute diseases.

cases, 14.3; for accidental injuries, 6.5 consultations. A relatively lower amount of care per patient was received for illnesses due to the communicable diseases, which received, on the average, 3.5 consulta-

TABLE 4.—*Frequency rate of disabling*[1] *illness receiving treatment from a physician, private duty or visiting nurse, and of physicians' and nurses' services, among 373,446 surveyed white children under 15 years of age in 31 cities of 100,000 population and over canvassed in 1935–36—disabling*[1] *illness from all causes and illness due to selected diseases or groups of diseases occurring in a 12-month period—sole or primary causes only*

Diagnosis	Disabling[1] illnesses receiving specified care per 1,000 persons under 15 years				Services for disabling[1] illness per 1,000 persons under 15 years			Frequency rate (disabling[1] illnesses per 1,000 persons under 15 years)
	Physician (home, office, or clinic)	Private duty nurse		Visiting nurse	Physician (home, office, or clinic)	Private duty nurse,[7] home and hospital	Visiting nurse	
		Hospital	Home					
All causes	144.2	1.07	1.53	29.53	623.9	48.61	93.71	211.7
Communicable diseases[2]	58.4	.11	.69	21.41	203.6	15.64	57.43	93.4
Diseases of the respiratory system, total	51.0	.36	.66	5.01	192.2	15.21	19.56	73.9
Tonsillitis	20.0	.17	.10	1.65	50.3	.87	4.06	25.7
Other minor respiratory diseases[3]	24.4	.04	.24	2.39	82.8	5.73	7.91	40.7
Pneumonia	6.6	.15	.32	.97	59.1	8.61	7.59	7.5
Diseases of the digestive system, total	5.9	.28	.01	.38	25.2	3.86	1.83	7.0
Appendicitis	3.4	.25	(*)	.16	14.3	3.08	.75	3.8
Other digestive diseases[4]	2.5	.03	.01	.22	10.9	.78	1.08	3.2
Major chronic diseases	5.8	.05	.06	.63	50.4	3.40	4.50	7.9
Tuberculosis, all forms	.3	--------	.01	.06	2.8	.10	.50	.5
Nervous and mental diseases[5]	1.7	.03	.01	.18	12.2	.80	.96	2.7
Rheumatism	1.0	(*)	.01	.11	10.2	1.22	.98	1.2
Degenerative diseases[6]	2.8	.02	.04	.28	25.2	1.22	2.06	3.5
Orthopedic impairments	.8	.02	(*)	.13	10.9	.81	1.40	1.2
Accidents	8.8	.07	.02	.40	56.8	5.07	1.67	10.8
All other causes	13.5	.18	.08	1.56	84.8	4.54	7.23	17.4

* The rate is 0.003 per 1,000, representing 1 illness of this category.
[1] See footnote 1, table 1.
[2] Include chiefly the communicable diseases of childhood: measles, mumps, chickenpox, whooping cough, scarlet fever, and diphtheria.
[3] Include influenza, colds, bronchitis, pleurisy, sinusitis, asthma, hay fever, and other diseases of the respiratory system except tonsillitis, pneumonia, and respiratory tuberculosis. In the period of childhood, the minor respiratory diseases predominate.
[4] Include indigestion, biliousness, diarrhea and enteritis, ulcer of the stomach or duodenum, diseases of the gall bladder or liver, and other diseases of the digestive system except appendicitis.
[5] Include mental defects.
[6] Include cancer; diabetes; cerebral hemorrhage and other forms of paralysis; diseases of the heart, arteriosclerosis and high blood pressure, and other diseases of the circulatory system, exclusive of hemorrhoids and varicose veins; nephritis and other nonvenereal diseases of the genitourinary system, exclusive of diseases of the female genital organs.
[7] In this survey the days of care by a private duty nurse in the home and hospital were not recorded separately.

tions; for tonsillitis, the average was 2.5, and for other minor respiratory diseases, 3.4 consultations.

The communicable and minor respiratory diseases occurred in about the same proportion among children's illnesses receiving bedside nursing care from a private duty nurse in the home as among those attended by a physician. Cases of pneumonia represented a relatively large proportion of the private duty nurses' child patients, and accounted for 18 percent of the total days of private duty nursing care received by children in the home or hospital.

The communicable and minor respiratory diseases accounted for 86 percent of the child patients of visiting nurses, and for 74 percent of their visits to children. Only 2.6 percent of all children's illnesses attended by a visiting nurse were included in the group of major chronic diseases and orthopedic impairments, and these cases received only 6.3 percent of the nurses' visits. Pneumonia accounted for 3 percent of all children's cases attended by a visiting nurse and absorbed 8 percent of all nursing visits to children.

Diseases of children receiving hospital care.—The frequency rates of hospitalized cases among children under 15 years of age according to cause are shown in figure 2, which includes rates for surveyed children

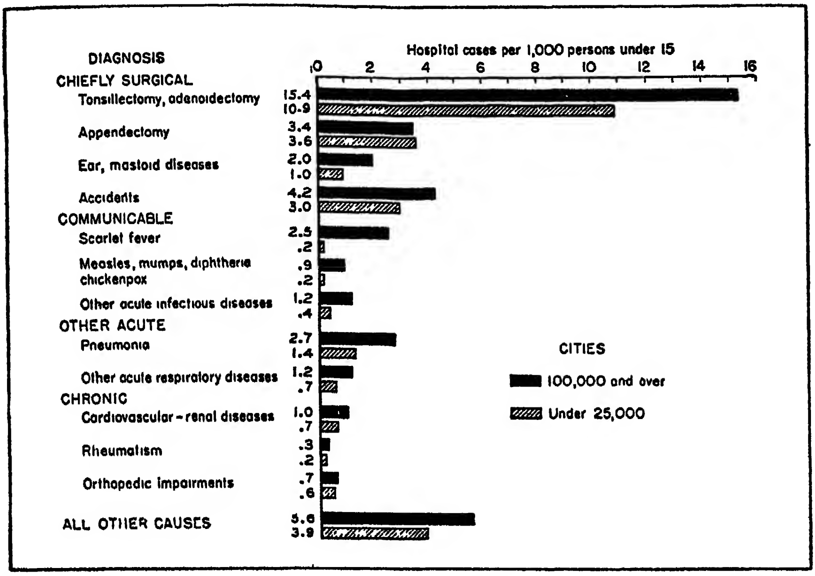

FIGURE 2.—Frequency rate of hospital cases classified by cause among children under 15 years of age in 31 cities of 100,000 population and over and in 42 cities under 25,000 population canvassed in 1935–36. "All other causes" is exclusive of all hospitalized cases of tuberculosis and of cases of mental and nervous disease or defect in an institution for 12 months.

in the large cities and in cities under 25,000 population. The hospital cases considered represent chiefly those treated in general and special hospitals, exclusive of institutions for the care of the tuberculous and mentally diseased.

In the surveyed cities of 100,000 population and over, the total incidence of "general" hospital cases among children under 15 years of age was 41.2 per 1,000 persons of these ages; in the cities under 25,000 population, the rate was 26.6. These rates are equivalent to a ratio of one hospital patient for every 24 children under 15 years of age in the large cities, and 1 patient for every 38 children in the small cities.

As a group, cases chiefly surgical in nature[10] were most frequent among the hospitalized illnesses of children. Diseases of the tonsils and adenoids, appendicitis, diseases of the ear and mastoid process, and accidents together accounted for 61 percent of the hospitalized illnesses of children in the large cities, and for 69 percent in the small cities. Diseases of the tonsils and adenoids alone accounted for 37

TABLE 5.—*Percentage of disabling*[1] *illnesses receiving no medical care, by cause in broad diagnosis groups according to income, among children in surveyed cities of three population classes—sole or primary causes only—518,767 white children*[2] *in 83 cities canvassed in 1935–36*

Diagnosis	Percentage of disabling illnesses receiving no medical care					
	All incomes[2]	Relief status and annual family income				
		Relief	Nonrelief			
			Under $1,000	$1,000–$2,000	$2,000–$3,000	$3,000 and over
	Cities of 100,000 and over					
All causes	27	28	32	28	23	18
Communicable diseases[3]	37	37	43	38	31	22
Minor diseases of the respiratory system except tonsillitis[4]	39	44	46	39	31	27
All other causes	9	10	11	9	7	6
	Cities of 25,000 100,000					
All causes	34	36	38	34	27	21
Communicable diseases[3]	49	53	54	49	30	32
Minor diseases of the respiratory system except tonsillitis[4]	39	45	46	37	20	22
All other causes	10	12	12	9	6	5
	Cities under 25,000					
All causes	41	46	45	39	33	26
Communicable diseases[3]	54	60	58	51	43	31
Minor diseases of the respiratory system except tonsillitis[4]	43	47	48	40	36	33
All other causes	13	17	16	10	7	11

[1] See footnote 1, table 1.
[2] Exclusive of children of these ages in families for which income was reported as unknown.
[3] For the diseases included, see footnote 2, table 4.
[4] For the diseases included, see footnote 3, table 4.

percent of all child hospital patients in the large cities, and for 41 percent in the small cities.

Practice in regard to the hospitalization of the acute communicable diseases of children showed characteristic differences with degree of urbanization, the frequency of these cases being relatively higher in

[10] The frequency rates shown in figure 2 are based on the total hospital cases, including both nonsurgical and surgical cases. The latter predominate, however. Thus, in the cities of 100,000 population and over, tonsillectomies were performed on 98 percent of the hospitalized cases of tonsillitis, appendectomies on 94 percent of the cases of appendicitis; surgical treatment was given in 84 percent of the cases of ear and mastoid disease, and in 68 percent of the accident cases. In the cities under 25,000 population, the corresponding figures were: tonsillitis, 99 percent; appendicitis, 97 percent; diseases of the ear and mastoid, 84 percent; and accidents, 75 percent.

the large than in the small cities. Hospitalized cases of pneumonia were relatively frequent in both groups of cities.

Medical care of childhood illness classified by cause and income.—In a preceding section, the association between family income and medical care of childhood illness has been examined, treatment received from a physician in the home, office, or clinic, and hospital medical care being considered separately. These groups are not mutually exclusive, since certain cases treated in the hospital were also cared for by a physician prior to or following hospitalization. This duplication can be eliminated by considering all illnesses receiving

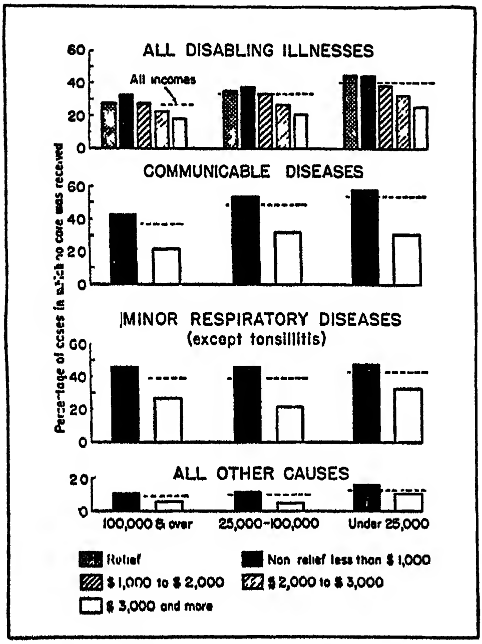

FIGURE 3. Percentage of disabling illnesses occurring in a 12-month period which received no medical care, among surveyed children under 15 years of age classified by size of the city of residence according to annual family income; and, for children in families with annual income under $1,000 (not on relief) and in families with annual income of $3,000 and over, the percentage of disabling illnesses due to certain broad groups of diseases which received no medical care—83 cities canvassed in 1935-36.

medical care from a physician, whether in the home, office, clinic, or hospital. Such illnesses form the basis for the rates shown in table 5, the proportion of unattended illnesses representing cases receiving no medical care from a physician in the home, clinic, hospital, or physician's office. The proportion of children's illnesses receiving no medical care in a 12-month period is shown for all causes of illness, and for two major groups of children's diseases, according to relief status and family income. Figure 3 presents the results graphically, the percentage of unattended illnesses by cause being shown only for

children in a low income group (nonrelief, income less than $1,000) and in the class with an income of $3,000 and over.

The results indicate that the largest proportion of unattended illnesses were included in the communicable and minor respiratory groups, exclusive of tonsillitis. In the large cities, 37 percent of all disabling illnesses due to the communicable diseases, and 39 percent of all cases of minor respiratory disease, exclusive of tonsillitis, received no medical care in the survey year, compared with 9 percent for all other causes of illness. In the small cities under 25,000 population, 54 percent of all disabling illnesses due to the communicable diseases were without medical attendance. The proportion of unattended illnesses decreased with increasing family income, but at each income level the proportion of illnesses receiving no medical care was found to be highest in the groups including illnesses due to the communicable and minor respiratory diseases, exclusive of tonsillitis.

TABLE 6.—*Physicians' services per case of disabling[1] illness attended for selected causes according to income, among 373,446 surveyed white children[2] under 15 years of age in 31 cities of 100,000 population and over—sole or primary causes only*

Diagnosis[3]	Services per case treated by a physician (home, office, or clinic)					
	All incomes[3]	Relief	Nonrelief			
			Under $1,000	$1,000–$2,000	$2,000–$3,000	$3,000 and over
All causes	4.3	3.9	4.3	4.3	4.6	5.4
Communicable diseases	3.5	3.0	3.3	3.1	4.1	4.8
Diseases of the respiratory system						
Tonsillitis	2.5	2.3	2.6	2.5	2.6	2.9
Other minor respiratory diseases	3.4	3.0	3.0	3.4	3.0	4.1
Pneumonia	8.9	6.8	8.5	10.1	10.8	12.1
Diseases of the digestive system						
Appendicitis	4.2	3.2	4.7	4.4	4.7	4.3
Other digestive diseases	4.4	4.0	4.4	4.6	4.6	5.5
Major chronic diseases						
Tuberculosis, all forms	10.0	(4)	(4)	(4)	(4)	(4)
Nervous and mental diseases	7.1	5.9	7.3	7.9	8.4	[5] 7.1
Rheumatism	10.1	7.1	12.3	9.2	14.1	[5] 19.1
Degenerative diseases	8.9	6.8	8.4	8.8	12.5	15.0
Orthopedic impairments[3]	14.3	15.5	11.7	12.7	[5] 12.4	[5] 21.0
Accidents	6.5	6.3	6.9	6.3	6.2	7.8
All other causes	6.2	5.2	5.8	6.6	7.0	9.1

[1] See footnote 1, table 1.
[2] Exclusive of children of these ages in families for which income was reported as unknown.
[3] For the definition of the diagnosis groups, see footnotes to table 4.
[4] The rate is shown for "all incomes" only because of the small number of cases.
[5] The rate represents the experience of 25 treated cases or less.

The illnesses of children in families in the upper income groups which had been attended by a physician received more intensive care than the attended cases in low income families, as is shown in table 6. The average attended case of communicable disease among children in relief families received 3 visits, compared with almost 5 visits per attended case among children in families with an income of $3,000

and over. For pneumonia, the average number of visits per attended case was approximately 7 among children in relief families, compared with 12 visits among children in the highest income group; for tonsillitis, the corresponding figures were 2, compared with 3 visits; and for other minor respiratory diseases, 3, compared with 4 visits. The same tendency toward more intensive care in the upper income families was observed for other diseases of childhood. The nature of the income differential was the same in cities of each population class, and figures for the intermediate and small surveyed cities are, therefore, not shown here.

SUMMARY

In a canvass of 83 representative urban communities conducted by the United States Public Health Service in 1935–36, records of medical and nursing care received in a 12-month period were obtained for 518,767 white children under 15 years of age. The medical and nursing services relate only to illnesses which had prevented the usual activities of the preschool child, or school attendance of the school child, for at least 7 consecutive days in the 12-month survey period. Certain facts established by an analysis of the survey records from this standpoint may be summarized as follows:

In general, a smaller proportion of the disabling illnesses of children than of adults received care from a physician in the home, clinic, or physician's office, but the age variation in the proportion of illnesses so attended was not marked except in cities under 25,000 population.

The average number of consultations with a physician per patient was lowest among children. Cases of the acute communicable and minor respiratory diseases accounted for almost three-fourths of the child patients attended by a physician outside the hospital, and for about one-half of the physicians' services to children; these diseases, on the average, do not require intensive medical supervision.

Among both children and adults, the proportion of disabling illnesses receiving bedside nursing care was relatively low compared with cases receiving care from a physician. The proportion of illnesses attended by a visiting nurse was highest in childhood, and decreased with age; private duty nursing care showed a reversal of this relation. Disabling illnesses due to the communicable and minor respiratory diseases accounted for the majority of child patients receiving bedside nursing care.

In the cities of 100,000 population and over, 1 in 24 children under 15 years of age had been a hospital patient in the survey year; in the small cities under 25,000 population, the ratio was 1 in 38. Over half of the hospital patients among children were surgical cases; diseases of the tonsils and adenoids alone accounted for about two-fifths of

the child patients. In the large cities, the frequency of hospitalized cases of the acute communicable diseases was relatively high; hospital care of these cases was infrequent in the cities under 25,000 population.

Among children in families on relief, and in self-sustaining families up to the $2,000 income level, the proportion of disabling illnesses receiving care from a physician outside the hospital was notably lower than in families with an income of $3,000 and over. This relation was observed consistently in the large, medium-sized, and small surveyed cities.

The nature of the association between family income and the receipt of hospital care by children showed variation with the size of the surveyed cities. In the small cities, the proportion of the illnesses of children receiving hospital medical care increased progressively as family income increased; in the large cities, this association was reversed. It was found that varying practice in large and small cities in the hospitalization of medical, as distinguished from surgical, cases among children largely accounted for this difference.

In each income class, the illnesses of children showing the highest proportion of cases without medical care were those due to the communicable and minor respiratory diseases, exclusive of tonsillitis; but the proportion of illnesses due to these diseases which received medical care increased with increasing family income.

The illnesses of children attended by a physician outside the hospital received more intensive care in high than in low income families for all of the diseases of childhood. The average number of hospital days per child patient, however, was consistently higher among low income families.

ACCURACY OF FOREIGN DERATIZATION EXEMPTION CERTIFICATES

For many years it has been a practice at the larger quarantine stations to make rat-infestation inspections on ships presenting recently dated deratization and deratization exemption certificates. From time to time it was reported that certain ships from foreign ports so inspected exhibited relatively heavy rat infestations at variance with statements on the certificates. To determine whether such instances were of sufficiently frequent occurrence to be a matter of concern, the Surgeon General directed that a study be instituted. This has been accomplished by carrying out, during the past 2 years at a number of stations, careful inspections of ships presenting deratization and deratization exemption certificates issued at a foreign port within 60 days of the date of arrival. In each instance copies of the certificate and of the inspection report were forwarded to the New

York Quarantine Station, where the aggregate results were compiled and tabulated.

This study has shown that:

1. Very few ships deratized (by fumigation) in foreign countries have exhibited a significant rat infestation; specifically, only 14 of 623 such ships showed infestations exceeding 10 rats.

2. Very few ships issued deratization exemption certificates in foreign countries have exhibited significant rat infestation; specifically, only 21 of 1,105 such ships showed infestations exceeding 10 rats.

No particular variations were noted in regard to ships from different countries. The essential data, tabulated as to the total vessels involved, are shown in table 1.

TABLE 1.—*Estimated number of rats on ships presenting deratization and deratization exemption certificates issued in foreign ports*

	All ships in class	Number of ships on which the following numbers of rats were estimated at the United States port of arrival—			
		None	1 to 5	6 to 10	11 or more
Ships presenting deratization certificates	623	500	90	19	14
Ships presenting deratization exemption certificates	1,105	990	86	8	21

It seems reasonable to believe that this is a clear indication of the uniformity of development in quarantine procedure all over the world as well as of the successful control of ship rats.

PROVISIONAL MORTALITY RATES FOR THE FIRST 9 MONTHS OF 1939

The mortality rates in this report are based upon preliminary data for 44 States, the District of Columbia, Alaska, and Hawaii for the first 9 months of 1939. The only States for which data are not available are Arizona, Arkansas, Mississippi, and New Hampshire. Comparative data for 43 States and the District of Columbia are presented for the first 9 months and by the three quarters of 1937–39.

This report is made possible through a cooperative arrangement with the respective States, which voluntarily furnish provisional quarterly and annual tabulations of current birth and death records. These reports are compiled and published by the United States Public Health Service.

Because of lack of uniformity in the method of classifying deaths according to cause, and because a certain number of certificates were not filed in time to be included, these data may differ in some instances from the final figures subsequently published by the Bureau of the Census.

In the past, these preliminary reports have provided an early and accurate index of the trend in mortality for the country as a whole. Some deviation from the final figures for individual States is to be expected, because of the provisional nature of the information. It is believed, however, that the trend of mortality within each State is correctly represented. Comparisons of specific causes of death among different States are subject to error because of differences in tabulation procedure and completeness of reporting. Comparisons of

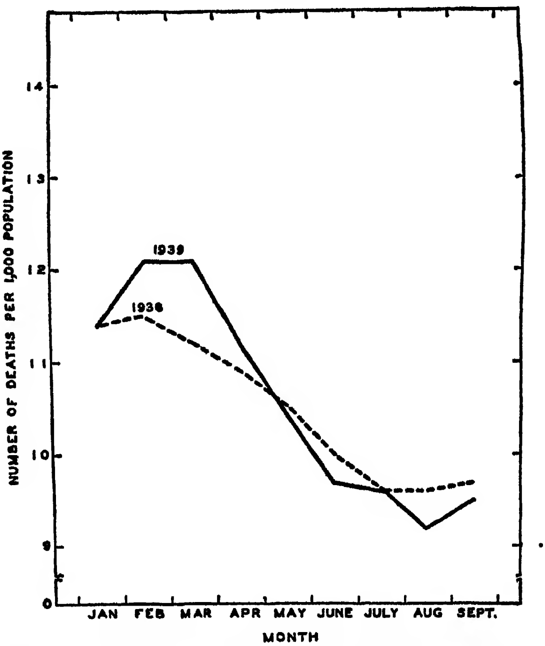

FIGURE 1.—Death rate per 1,000 population, by months, 1938 and 1939.

this nature should be made only from the final figures published by the Bureau of the Census.

The death rate from all causes, 10.6 per 1,000 population, although slightly higher than the corresponding rate for 1938, 10.5 per 1,000 population, was 5 percent less than the rate for 1937. When it is recalled that the mortality rate for 1938 was the lowest on record, the experience during the first 9 months of 1939 is very favorable. Moreover, since the minor outbreak of influenza during the first quarter, the death rate this year has been even lower than that for 1938.

The principal diseases responsible for the slight increase in mortality as compared with last year are influenza, cancer, diabetes, cerebral hemorrhage, and heart disease. With the exception of influenza, these diseases have been increasing for a number of years, owing, in part at least, to the increasing proportions of the population

in the older age groups. In addition to these 5 causes, poliomyelitis was also slightly more prevalent this year than in 1938.

Each of the remaining diseases for which data are presented in the following table caused relatively fewer deaths during the first three quarters of 1939 than during the corresponding period in 1938. Especially gratifying is the decline in infant and maternal mortality, the former declining 9.4 percent and the latter declining 9.5 percent during the 9-month period.

Tuberculosis continued its steady decline and reached a low death rate of 45.7 per 100,000 population, about 4 percent less than the low rate of 1938. The first 9 months of 1939 were unusually free from outbreaks of the principal diseases of early childhood, measles, scarlet fever, whooping cough, and diphtheria. The mortality rate from these 4 diseases was 45 percent less than during the corresponding period of 1938.

For the second consecutive year the mortality rate from automobile accidents has declined; the decrease during this 9-month period, 2.7 percent, while less than the corresponding decrease during the first 9 months of 1938, 19.6 percent, is still noteworthy.

The birth rate, which rose slightly during 1938, decreased slightly during the first 3 quarters of 1939, but is still about 2 percent above the rate for 1937. The crude rate of natural increase, 6.2 per 1,000 population, was 6 percent lower than during the first 9 months of 1938.

Provisional mortality from certain causes in the first 9 months of 1939, with comparative provisional data for the corresponding period in preceding years

State and period	All causes, rate per 1,000 population (annual basis)	Births (exclusive of stillbirths) per 1,000 population (annual basis)	Rate per 1,000 live births: Total infant mortality	Rate per 1,000 live births: Maternal mortality	Death rate per 100,000 population (annual basis): Typhoid fever (1, 2)	Measles (7)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Influenza (11)	Acute poliomyelitis and polioencephalitis (16)	Encephalitis, epidemic or lethargic (17)	Epidemic cerebrospinal meningitis (18)	Tuberculosis, all forms (23–32)	Cancer, all forms (45–53)	Diabetes (59)	Cerebral hemorrhage, apoplexy (82a, b)	Diseases of the heart (90–95)	Pneumonia, all forms (107–109)	Diseases of the digestive system (115–129)	Diarrhea and enteritis under 2 years (119)	Nephritis (130–132)	All accidents (176–195, 201–214)	Automobile accidents (206, 208, 210)
44 STATES [1]																								
January–September:																								
1939	10.6	16.8	46	3.8	1.3	1.0	0.7	2.2	1.1	17.2	0.5	0.5	0.5	45.7	118.1	25.7	86.5	282.2	60.7	59.8	7.1	74.6	63.4	21.5
1938	10.5	17.1	49	4.2	1.5	3.0	1.0	3.6	1.4	11.3	.4	.6	.8	47.7	116.0	23.9	83.4	266.0	65.4	63.7	9.9	76.7	69.0	22.1
1937	11.2	16.5	54	4.8	1.7	.9	1.5	3.7	1.5	32.4	1.0	.7	1.8	52.6	112.5	24.1	84.8	266.4	86.4	66.0	9.7	79.3	78.7	27.5
January–March:																								
1939	11.9	16.3	54	4.1	.8	1.4	1.2	2.4	1.6	32.1	.2	.5	.7	46.9	119.0	29.7	96.5	323.4	104.1	55.7	4.1	84.6	64.1	19.4
1938	11.4	16.6	52	4.4	.8	4.0	1.7	3.4	1.9	21.6	.3	.6	1.2	48.7	115.3	26.5	90.3	292.9	103.4	55.9	4.2	83.0	64.8	20.8
1937	12.9	15.6	64	5.6	.9	.8	2.5	3.3	2.1	74.1	.3	.7	2.7	55.9	112.0	28.7	95.3	309.0	149.4	59.8	4.5	87.8	73.3	25.6
April–June:																								
1939	10.4	16.4	45	3.9	.8	1.3	.7	2.3	.8	16.4	.3	.4	.5	48.0	117.9	25.5	86.2	280.9	51.7	57.9	5.9	75.1	67.0	20.2
1938	10.5	16.8	50	4.3	1.1	4.4	1.0	4.1	1.0	8.6	.3	.6	.8	49.8	116.4	23.8	83.8	263.2	60.0	64.7	10.0	78.6	65.1	20.3
1937	10.9	16.3	51	4.8	1.1	1.3	1.7	3.3	1.1	19.4	.3	.6	1.9	54.2	112.3	23.0	84.1	263.2	75.8	64.1	7.7	81.2	76.1	25.8
July–September:																								
1939	9.4	17.7	41	3.5	2.3	.3	.3	1.9	.9	3.3	1.0	.5	.4	42.2	117.3	22.1	77.1	242.7	27.2	65.5	11.2	64.5	74.0	24.8
1938	9.6	18.0	46	4.0	2.5	.8	.4	3.4	1.2	3.9	.4	.7	.5	44.7	116.1	21.4	76.1	237.6	33.6	70.2	15.4	68.7	76.9	25.3
1937	9.8	17.6	47	4.2	3.2	.5	.5	4.7	1.2	4.3	2.3	.6	.8	47.9	113.1	20.7	75.1	227.8	35.3	73.9	16.8	69.1	86.4	31.0
Metropolitan Life Insurance Co., industrial policyholders (January–September): [2]																								
1939	7.8	------	------	------	.7	.7	.8	1.8	1.1	11.1	------	------	------	46.0	100.5	28.0	60.2	[3] 162.4	46.7	------	[4] 5.5	[5] 52.1	46.3	16.1
1938	7.7	------	------	------	1.0	2.0	1.2	2.2	1.4	7.4	------	------	------	47.6	95.5	24.4	57.6	[3] 151.9	53.1	------	[4] 7.3	[5] 53.1	48.3	16.9
1937	8.4	------	------	------	.9	1.2	1.7	3.3	1.5	21.0	------	------	------	53.0	93.4	25.3	59.0	[3] 158.8	71.4	------	[4] 9.0	[5] 55.1	54.0	20.2
Alabama:																								
1939	9.8	21.1	60	5.9	2.0	2.5	0.5	6.1	1.9	35.0	0.5	0.4	0.9	53.5	57.2	11.5	68.3	162.0	67.7	58.5	14.9	66.3	63.8	19.5
1938	10.3	21.5	63	6.5	2.3	7.6	.6	6.8	2.9	21.3	.6	.6	2.3	55.4	55.2	11.5	68.4	162.7	73.5	70.8	21.0	77.1	64.6	18.4
1937	10.7	21.3	65	5.9	2.2	.1	.3	7.3	2.2	57.2	.6	.5	4.0	62.4	57.5	9.8	64.2	159.6	87.9	66.3	17.7	76.5	69.6	21.3

Alaska:																								
1939	16.7	2.5	99	3.7	(6)	4.1	12.3	32.9	2.1	23.7	(6)	2.1	(6)	380.5	84.3	4.1	65.8	238.6	148.1	45.3	(6)	32.9	160.4	(6)
1938	22.5	3.0	87	.7	2.1	2.1	2.1	51.6	4.2	53.0	2.1	(6)	(6)	507.2	78.5	(6)	157.0	275.9	255.8	44.6	(6)	12.7	214.3	(6)
1937	18.7	2.6	136	12.4	2.2	4.4	2.2	37.9	(6)	49.0	4.4	2.2	17.8	335.5	57.9	6.7	64.6	343.2	182.7	66.8	11.1	24.5	185.0	2.2
California:																								
1939	12.2	1.5	40	3.2	.9	1.3	.5	.8	.9	3.6	1.2	.4	.5	63.3	152.6	23.4	92.1	360.4	49.8	78.3	7.5	76.1	94.2	42.3
1938	12.0	1.3	43	3.6	1.1	1.2	.4	2.6	1.4	4.2	.3	.7	.9	67.0	147.3	24.0	87.9	343.2	56.0	75.8	8.2	80.9	93.7	42.8
1937	13.2	1.1	54	4.4	1.0	.7	.8	5.2	1.6	25.5	1.3	.8	1.9	75.4	138.4	23.4	85.3	368.0	86.7	84.3	11.6	84.1	105.5	48.1
Colorado:																								
1939	11.6	1.1	55	5.2	2.0	1.6	1.1	5.8	3.1	22.6	.9	.5	.9	57.9	120.3	17.	91.3	246.0	89.2	67.	10.3	78.9	90.1	28.4
1938	11.5	1.9	53	4.6	1.6	3.7	1.0	4.0	3.4	13.7	.6	1.9	.6	63.4	116.0	17.	89.5	239.2	94.8	72.	13.2	84.1	92.9	30.8
1937	13.4	1.7	71	5.8	2.2	.2	2.4	5.5	2.5	61.0	4.4	1.2	3.7	68.0	116.3	16.	86.1	212.2	184.4	84.	23.2	80.0	97.4	35.5
Connecticut:																								
1939	9.7	1.5	37	3.2	.4	.6	.2	1.2	.4	5.7	.1	.2	.1	34.6	136.1	28.	81.2	273.7	45.7	46.	2.1	75.3	56.4	16.0
1938	10.0	1.5	36	2.8	.5	(6)	.3	.5	.7	4.1	(6)	.2	.2	34.9	139.1	28.	85.8	245.6	52.4	49.	3.2	73.8	70.7	17.6
1937	10.2	1.9	41	3.3	.2	.8	.8	1.4	1.1	13.9	.4	.4	.8	38.1	125.1	31.	84.8	231.3	69.8	47.	3.3	79.2	69.3	22.3
Delaware:																								
1939	12.2	1.5	46	4.6	2.0	(6)	.5	3.1	1.0	12.7	(6)	1.5	2.0	61.0	116.4	34.	112.9	370.6	74.7	54.	6.1	111.8	75.2	33.6
1938	12.2	1.7	53	9.7	.5	1.0	.5	6.6	1.0	11.7	(6)	(6)	.5	49.0	125.0	30.	102.6	364.4	73.5	61.	9.7	107.7	81.6	27.6
1937	13.7	1.9	69	9.2	2.6	1.5	(6)	8.2	.5	28.1	.5	(6)	2.0	59.9	114.7	27.	104.5	352.9	104.0	80.	9.2	137.8	110.6	39.4
District of Columbia:																								
1939	12.8	2.8	47	5.1	.2	.4	(6)	2.1	.6	10.8	(6)	.2	.8	69.9	157.8	26.	79.2	335.8	74.4	81.	11.9	106.5	75.9	22.0
1938	12.5	2.1	49	5.2	.8	.4	.6	.6	.8	5.0	.4	.6	1.7	74.0	133.3	23.	83.6	333.5	59.3	76.	12.2	101.7	67.2	20.6
1937	14.2	1.7	63	6.0	1.5	2.8	.6	3.4	2.1	19.4	.6	.8	5.5	92.5	142.9	27.	98.7	328.6	130.5	78.	11.9	93.5	81.0	26.4
Florida:																								
1939	12.0	1.4	59	6.6	1.6	.9	.2	3.7	1.7	25.3	.4	.2	.6	53.1	99.0	21.	100.0	255.1	57.1	83.	12.7	98.5	97.1	37.5
1938	12.2	1.1	59	7.7	3.3	1.9	.2	4.3	1.9	21.9	.7	.6	1.0	57.7	99.2	19.	93.3	250.1	68.8	59.	13.8	95.9	98.4	39.3
1937	12.2	1.4	61	6.5	3.5	.2	.1	3.5	2.5	38.9	.2	.4	4.9	58.9	92.3	17.	103.1	231.9	65.2	88.	11.8	99.6	103.3	39.6
Georgia:																								
1939	9.6	1.3	61	5.8	2.7	2.1	.4	4.2	1.9	29.4	.4	.1	.4	46.6	59.6	11.	89.8	161.9	67.5	58.	14.7	59.5	53.4	18.4
1938	10.5	1.8	70	6.6	4.4	6.1	.3	7.9	2.3	24.3	.6	.2	.8	51.4	59.9	12.	84.1	163.8	81.8	73.	24.2	110.7	63.8	23.5
1937	10.5	1.4	63	7.2	4.7	.2	.3	4.8	2.6	48.3	.6	.2	1.2	50.1	55.1	11.	80.5	162.1	85.6	69.	17.3	103.9	72.6	27.8
Hawaii:																								
1939	6.9	1.9	58	3.2	1.1	(6)	(6)	7.2	1.1	3.7	1.1	.6	(6)	60.7	62.1	14.	43.8	117.4	52.1	48.	10.3	61.0	43.2	12.6
1938	7.2	1.8	57	3.8	1.4	.3	.3	4.7	.6	4.1	.6	.6	.6	58.1	62.8	15.	51.4	117.1	64.5	50.	11.7	54.0	53.4	15.5
1937	8.3	2.1	70	4.9	1.5	55.2	(6)	1.2	3.3	8.4	.3	(6)	.6	76.7	69.2	16.	40.6	111.9	91.6	59.	17.3	65.0	48.6	15.8
Idaho:																								
1939	9.4	2.2	45	2.5	3.2	1.1	.5	2.4	1.1	15.9	.5	1.6	1.6	19.3	91.3	21.	63.5	246.5	60.6	55.	4.5	51.1	97.7	31.5
1938	9.0	2.9	42	3.6	1.9	.8	.8	3.5	.5	16.8	.3	1.3	1.9	20.8	83.4	10.	64.7	184.5	74.6	57.	3.7	56.0	87.2	32.4
1937	9.8	2.6	43	3.8	1.6	3.5	1.9	2.7	.8	47.2	.3	1.1	1.1	20.3	81.9	11.	69.4	152.7	75.9	72.	7.0	67.0	109.0	37.7
Illinois:																								
1939	11.0	1.7	39	3.1	1.4	.1	1.0	2.2	1.5	14.6	.3	.3	.2	47.4	140.0	29.	73.9	336.3	56.4	61.	3.2	93.9	66.2	24.3
1938	10.6	1.2	41	3.3	.7	3.5	1.8	1.7	1.4	5.3	.2	.4	.3	46.5	134.8	27.	72.1	307.1	55.5	64.	6.2	91.3	71.7	24.0
1937	11.2	1.2	45	4.1	.8	.2	2.3	2.1	2.0	20.8	1.2	.4	1.4	52.0	129.7	27.	69.8	294.2	71.6	71.	4.8	95.3	78.3	30.7
Indiana:																								
1939	11.0	1.4	42	4.1	1.2	.2	1.5	1.8	1.4	33.3	.2	.5	.4	41.0	110.9	16.	123.5	244.3	72.2	(7)	5.7	61.6	70.4	26.8
1938	10.5	1.9	43	4.2	.7	4.0	1.8	1.6	1.8	11.5	.3	.6	.7	39.4	110.6	15.	117.4	229.6	64.0	(7)	8.6	63.1	71.6	28.9
1937	11.3	1.8	53	3.8	1.3	.4	3.1	5.3	1.2	33.1	1.0	.5	1.8	46.3	108.0	14.	118.2	242.7	92.4	(7)	9.2	63.7	85.0	37.8
Iowa:																								
1939	9.9	1.9	37	2.4	.7	1.4	1.0	1.8	.5	23.9	.5	.6	.5	18.6	123.2	25.	101.7	265.3	53.5	56.	2.3	53.9	64.7	18.5
1938	9.3	1.3	37	3.3	.6	1.3	2.1	2.8	.8	12.0	.5	1.0	.7	10.1	125.2	21.	96.4	237.1	56.5	56.	3.6	55.7	63.4	16.4
1937	9.8	1.7	43	4.7	.7	.1	4.2	3.5	.3	30.0	1.6	.7	1.0	21.0	124.2	20.	101.6	216.8	64.5	56.	4.3	59.4	74.8	21.6

See footnotes at end of table.

Provisional mortality from certain causes in the first 9 months of 1939, with comparative provisional data for the corresponding period in preceding years—Continued

State and period	All causes, rate per 1,000 population (annual basis)	Births (exclusive of stillbirths) per 1,000 population (annual basis)	Rate per 1,000 live births: Total infant mortality	Rate per 1,000 live births: Maternal mortality	Death rate per 100,000 population (annual basis): Typhoid fever (1, 2)	Measles (7)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Influenza (11)	Acute poliomyelitis and polioencephalitis (16)	Encephalitis, epidemic or lethargic (17)	Epidemic cerebrospinal meningitis (18)	Tuberculosis, all forms (23-32)	Cancer, all forms (45-53)	Diabetes (59)	Cerebral hemorrhage, apoplexy (82a, b)	Diseases of the heart (90-95)	Pneumonia, all forms (107-109)	Diseases of the digestive system (115-129)	Diarrhea and enteritis under 2 years (119)	Nephritis (130-132)	All accidents (176-195, 201-214)	Automobile accidents (206, 208, 210)
Kansas:																								
1939	9.9	15.2	40	4.0	0.6	0.1	0.7	0.6	0.4	18.6	0.2	1.4	0.4	22.2	119.1	26.0	94.1	247.6	44.4	59.5	4.1	95.3	98.9	20.8
1938	9.9	15.7	42	4.1	.9	1.7	1.5	3.1	.5	15.7	(6)	1.0	.4	23.5	120.4	23.7	96.0	228.8	48.5	62.2	5.1	95.7	101.2	22.8
1937	10.4	15.2	46	4.4	.7	.1	4.3	2.7	1.4	40.6	2.0	1.4	1.4	27.5	114.8	22.8	97.8	230.9	64.1	64.1	6.0	86.6	113.2	24.8
Kentucky:																								
1939	9.3	19.5	49	4.2	3.8	1.3	.9	1.7	2.1	34.8	.6	.7	1.2	61.4	72.9	11.7	92.1	195.5	64.4	62.4	18.5	60.7	67.3	19.2
1938	9.1	22.2	51	4.0	3.8	4.7	1.3	7.3	2.4	21.8	.9	.2	2.2	66.6	67.7	12.6	92.0	176.3	66.2	79.9	32.6	67.0	56.1	19.7
1937	10.2	20.1	51	4.0	5.3	3.5	1.4	7.8	3.4	57.3	1.2	.6	2.9	66.6	66.2	10.8	83.1	157.4	89.0	74.5	24.7	63.9	68.7	24.4
Louisiana:																								
1939	11.3	21.5	62	6.1	7.2	5.8	.2	5.3	2.4	27.0	.5	.4	.5	65.7	82.7	17.5	74.0	229.5	88.0	74.8	14.5	100.3	65.6	19.0
1938	11.3	21.7	66	6.4	5.9	.7	.3	4.7	2.6	24.8	.4	.5	1.1	68.5	57.2	17.5	66.5	210.4	90.2	78.2	18.4	100.5	63.8	20.0
1937	11.6	20.1	68	8.0	6.5	1.1	.7	7.5	2.8	62.0	.8	.4	1.4	72.0	79.6	16.6	67.2	203.1	101.5	75.4	17.6	101.3	68.7	20.8
Maine:																								
1939	12.6	17.5	52	4.0	1.2	.6	.3	3.3	2.5	22.1	.9	.5	.2	83.3	147.2	25.7	126.2	373.7	77.1	52.5	5.4	78.2	70.4	20.5
1938	11.9	17.8	49	4.3	1.9	2.0	(6)	2.3	.6	16.0	.6	.2	(6)	29.8	144.4	27.3	112.7	332.5	73.1	57.8	8.6	83.0	63.3	18.8
1937	13.4	18.5	60	5.1	1.6	.3	.5	2.8	.5	45.3	2.0	.2	.8	31.9	149.2	23.0	123.7	366.3	98.9	58.6	13.3	84.2	67.5	15.8
Maryland:																								
1939	12.3	16.9	49	3.2	1.1	1.3	.2	1.2	1.0	11.0	.1	.5	.7	78.5	141.0	29.8	100.5	333.0	74.7	57.1	8.2	124.6	74.0	22.4
1938	12.3	17.4	57	3.8	1.7	.6	.6	3.3	.7	8.1	.1	1.1	1.0	79.1	134.8	29.0	100.5	319.6	81.1	63.0	12.4	130.6	72.3	21.4
1937	13.3	16.6	63	4.1	1.9	2.9	.8	6.3	1.4	19.0	1.3	1.6	3.2	86.0	132.2	27.2	110.6	308.5	111.9	72.2	15.1	140.6	92.4	29.7
Massachusetts:																								
1939	10.4	------	------	------	.3	.5	.4	1.2	.2	5.7	(6)	.2	.5	33.9	143.8	32.4	92.5	366.8	68.4	49.8	1.9	59.4	53.9	11.7
1938	11.0	------	------	------	.3	.3	.7	.9	.3	3.7	.3	.2	.6	37.9	154.3	32.2	96.1	359.6	74.6	54.6	2.6	68.4	59.1	13.8
1937	11.6	------	------	------	.2	.8	1.0	2.3	.3	11.5	.6	.3	1.8	41.3	148.2	34.8	95.2	361.2	101.8	62.6	3.1	71.8	64.2	17.3
Michigan:																								
1939	10.7	19.2	42	3.1	.6	.8	1.7	1.7	.6	19.3	.8	.2	.4	39.3	123.0	27.7	87.6	303.6	59.7	60.7	5.1	57.9	74.9	25.2
1938	10.3	19.8	44	3.6	.6	2.6	1.9	2.6	.8	6.3	.2	.2	.4	40.3	116.6	25.8	88.2	278.1	56.4	62.3	6.7	55.4	70.9	25.7
1937	11.2	18.6	50	3.7	.7	.2	3.4	2.9	1.2	21.6	1.2	.2	1.0	45.5	114.1	25.6	86.7	271.6	86.4	67.0	5.8	61.0	91.6	38.8

Minnesota:																								
1939	9.9	18.4	37	2.7	.1	3.2	.5	.5	.4	14.8	1.4	.4	.2	31.5	139.9	26.6	94.3	260.6	62.2	57.6	3.7	40.0	69.3	19.5
1938	9.5	17.9	38	3.2	.4	.8	1.2	2.2	.4	8.4	.4	.8	.4	29.1	140.3	24.8	85.1	236.5	63.0	54.3	3.0	42.1	69.9	23.2
1937	10.1	18.0	42	3.0	.3	.3	1.7	2.5	.4	29.8	1.6	1.0	1.1	35.0	139.2	23.3	86.5	228.3	77.1	56.4	2.8	44.9	74.0	22.0
Missouri:																								
1939	11.0	15.9	44	3.5	2.2	.2	.9	1.8	1.6	22.9	.5	.4	.5	45.5	125.1	24.0	89.0	263.0	81.0	63.7	8.3	107.7	66.3	19.4
1938	11.0	15.6	49	3.7	2.3	6.5	2.2	4.7	2.3	16.7	.5	.6	.5	50.0	124.3	22.5	87.2	259.9	89.4	63.6	10.6	104.0	68.7	22.1
1937	11.9	13.8	61	5.3	3.6	.4	2.9	4.4	1.9	43.5	1.4	1.0	1.3	57.6	120.9	22.9	92.7	262.7	123.6	63.0	10.5	102.5	80.5	26.2
Montana:																								
1939	10.8	19.7	52	3.4	2.4	3.9	1.0	3.6	1.2	21.9	(6)	1.2	1.2	45.5	117.9	19.4	91.2	230.0	68.8	66.8	4.9	58.6	95.5	26.3
1938	10.4	19.6	42	3.6	.7	1.5	2.0	8.8	2.0	21.1	.2	5.6	2.0	44.4	97.1	15.9	87.8	212.7	76.5	67.5	6.1	51.5	103.3	23.8
1937	11.6	19.2	50	3.9	2.7	.5	2.5	2.7	2.0	68.0	1.2	.7	1.7	43.9	105.9	20.1	92.3	209.4	110.9	70.9	5.0	65.2	109.1	30.5
Nebraska:																								
1939	9.0	16.0	34	3.4	.5	1.4	1.0	1.3	.9	18.9	.4	.4	.2	16.6	112.2	24.2	88.0	199.3	54.3	55.2	2.2	65.5	69.8	20.3
1938	8.7	16.0	37	3.3	.5	.9	1.3	2.6	.9	11.0	.4	.8	.5	16.8	120.2	24.5	82.9	217.0	52.7	50.2	2.5	60.0	57.1	17.2
1937	9.7	16.0	43	4.2	.5	.4	3.4	2.0	1.0	52.9	3.9	1.0	1.3	20.4	111.2	26.8	86.4	216.8	62.5	63.2	4.2	64.4	66.4	23.0
Nevada:																								
1939	11.7	18.0	43	5.1	1.3	2.6	(6)	(6)	(6)	6.5	(6)	(6)	1.3	53.2	107.7	10.4	75.3	260.4	92.2	40.2	(6)	44.1	206.4	72.7
1938	11.9	17.7	36	2.2	3.9	(6)	(6)	1.3	3.9	1.3	(6)	(6)	(6)	70.8	94.4	13.1	74.7	276.6	100.9	62.9	5.2	40.6	135.0	57.7
1937	12.6	15.0	49	8.8	(6)	(6)	2.6	2.6	(6)	11.9	(6)	(6)	(6)	74.1	71.5	11.9	82.1	242.2	127.1	58.2	4.0	80.6	166.8	58.9
New Jersey:																								
1939	10.0	13.1	39	3.0	.3	(6)	.5	1.2	.4	6.4	.7	.6	.4	42.8	131.1	31.8	81.0	334.9	47.2	53.7	2.7	65.0	54.1	17.4
1938	9.9	13.0	39	3.4	.4	.9	.3	1.1	.7	4.8	.2	.7	.5	45.6	125.6	28.5	79.4	315.9	56.7	57.1	3.0	69.4	58.1	19.5
1937	10.2	12.6	40	3.3	.7	1.6	.4	1.2	.5	11.8	.5	.5	1.2	48.0	121.2	31.1	76.1	307.5	69.9	57.5	3.0	71.5	72.9	24.8
New Mexico:																								
1939	13.6	36.9	98	4.3	3.5	1.3	.6	8.8	4.4	29.8	1.6	(6)	1.6	87.9	65.3	9.7	47.4	131.8	107.7	104.2	44.3	59.6	101.4	44.3
1938	13.1	35.5	93	4.9	3.8	15.8	1.0	17.4	3.2	14.2	1.0	(6)	.6	91.6	66.5	7.3	50.7	134.3	85.5	114.0	48.5	64.3	93.8	33.6
New York:																								
1939	11.4	14.5	39	3.0	.4	.5	.4	1.0	.3	4.8	.4	.5	.5	49.6	154.6	40.3	67.1	369.2	60.1	61.5	4.5	68.5	61.5	16.2
1938	11.3	14.7	41	3.8	.4	.8	.6	1.5	.3	3.7	.2	.7	.8	51.6	153.9	36.4	64.5	360.2	65.8	62.7	5.2	72.1	64.5	17.5
1937	12.0	14.6	46	4.0	.5	.6	.8	1.3	.7	11.9	.4	.7	1.3	59.7	149.8	37.5	73.9	362.2	93.3	69.1	6.3	76.8	72.3	21.7
North Carolina:																								
1939	8.8	22.2	59	5.2	1.4	2.1	.4	7.3	2.6	19.3	.2	.2	.5	50.8	54.5	12.9	79.4	157.0	60.5	64.6	20.0	80.6	61.1	23.4
1938	9.6	22.6	68	6.1	2.2	9.0	.5	8.3	3.6	13.9	.3	.4	.9	55.0	54.4	10.5	78.7	161.0	76.0	79.7	32.9	59.6	60.9	22.5
1937	9.7	22.9	65	5.4	2.6	1.3	.3	4.7	2.8	29.4	.5	.5	1.1	55.7	52.8	10.4	77.4	156.6	83.6	72.7	23.6	53.7	69.8	27.3
North Dakota:																								
1939	7.1	18.9	45	2.7	.8	3.8	.9	1.9	.8	19.6	(6)	.8	.6	19.4	78.1	19.0	64.2	174.4	50.7	44.4	5.6	35.4	39.5	10.7
1938	7.3	18.8	47	2.5	.2	2.8	3.0	9.2	.8	9.8	(6)	4.7	1.5	21.8	89.9	20.4	60.4	143.7	50.4	51.0	6.0	40.2	48.3	15.9
1937	8.0	18.7	53	4.6	.2	(6)	1.3	.9	.8	34.5	(6)	.8	2.3	26.1	78.0	17.2	71.0	163.6	68.7	54.2	10.0	33.7	57.6	16.5
Ohio:																								
1939	11.4	15.7	42	3.8	.7	.1	1.2	1.3	.8	22.1	.2	.6	.2	44.1	133.7	28.9	109.8	301.1	63.2	57.4	5.3	78.1	52.3	25.3
1938	11.0	16.8	44	3.9	.8	3.5	1.3	2.1	1.1	11.4	.2	.4	.7	48.3	129.2	27.1	103.7	274.9	61.0	60.6	7.1	75.5	72.7	25.5
1937	12.0	15.6	51	4.9	1.6	1.7	1.9	5.0	1.2	34.9	1.0	1.0	1.6	52.2	119.2	26.5	108.3	282.3	86.1	70.0	9.0	79.3	96.9	36.8
Oklahoma:																								
1939	8.2	16.9	55	4.4	3.7	3.9	.8	1.1	2.3	21.5	.4	.6	.4	42.3	71.0	12.6	79.0	140.7	59.4	58.7	9.2	52.7	79.4	19.3
1938	7.9	17.5	42	4.2	4.0	2.6	.7	8.7	4.0	16.5	1.1	.3	1.0	45.4	69.9	12.5	64.3	127.8	56.6	55.1	9.6	58.2	66.2	20.7
1937	8.7	16.2	59	8.0	4.9	1.3	1.3	2.7	2.5	48.9	2.4	.3	2.3	51.8	72.0	12.8	61.0	130.1	76.7	64.9	11.5	63.6	62.8	24.1
Oregon:																								
1939	11.2	16.1	36	2.3	1.0	.9	.6	.9	.3	8.6	.3	.8	.3	30.6	134.2	24.4	109.7	290.5	44.2	43.7	1.9	117.9	93.3	28.5
1938	11.3	15.9	36	3.2	.4	.4	1.0	2.1	1.0	9.0	.4	1.8	1.0	29.8	136.0	23.2	96.0	272.2	54.8	48.5	1.8	109.7	92.8	29.3
1937	12.2	15.2	42	3.8	.8	.1	1.0	2.3	.3	37.2	.6	.9	.6	35.5	120.4	22.0	105.7	278.5	67.7	53.1	1.2	106.4	91.6	31.0

See footnotes at end of table.

Provisional mortality from certain causes in the first 9 months of 1939, with comparative provisional data for the corresponding period in preceding years—Continued

State and period	All causes, rate per 1,000 population (annual basis)	Births (exclusive of stillbirths) per 1,000 population (annual basis)	Rate per 1,000 live births: Total infant mortality	Rate per 1,000 live births: Maternal mortality	Death rate per 100,000 population (annual basis): Typhoid fever (1, 2)	Measles (7)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Influenza (11)	Acute poliomyelitis and polioencephalitis (16)	Encephalitis, epidemic or lethargic (17)	Epidemic cerebrospinal meningitis (18)	Tuberculosis, all forms (23–32)	Cancer, all forms (45–53)	Diabetes (59)	Cerebral hemorrhage, apoplexy (82a, b)	Diseases of the heart (90–95)	Pneumonia, all forms (107–109)	Diseases of the digestive system (115–129)	Diarrhea and enteritis under 2 years (119)	Nephritis (130–132)	All accidents (176–195, 201–214)	Automobile accidents (206, 208, 210)
Pennsylvania:																								
1939	10.3	15.9	44	3.3	0.6	0.1	0.5	1.5	0.6	13.5	0.3	0.7	0.6	39.8	119.7	32.5	79.9	309.8	50.4	51.5	4.5	81.3	50.9	13.7
1938	10.4	16.4	46	3.6	.9	3.0	1.3	1.7	.9	10.0	.1	.7	.7	41.1	116.7	29.7	79.2	295.4	59.6	55.9	5.5	79.7	56.6	15.4
1937	11.2	16.0	51	4.2	1.0	.8	1.6	2.9	.9	31.1	.4	.7	1.4	47.6	116.1	30.8	78.4	298.0	77.9	56.5	6.2	85.2	62.4	20.3
Rhode Island:																								
1939	11.4	15.2	39	3.2	(6)	.2	(6)	2.7	.2	6.7	(6)	(6)	.4	41.4	158.8	33.7	89.6	370.1	64.9	64.1	4.5	99.6	51.2	10.6
1938	12.3	15.8	41	2.1	.4	(6)	.4	1.4	.2	5.1	.2	.8	1.0	42.2	159.8	41.2	87.2	354.6	88.9	60.7	3.9	109.6	105.0	11.8
1937	12.4	15.2	48	3.6	.2	.6	1.8	2.9	.4	13.7	(6)	.4	2.7	47.7	157.6	42.6	97.6	369.5	101.7	59.9	4.5	111.7	53.2	17.9
South Carolina:																								
1939	9.5	20.0	71	6.1	5.3	.6	.1	7.7	2.3	26.8	2.8	.2	.4	42.5	50.3	12.6	90.1	178.5	61.6	42.8	7.7	84.0	60.3	23.4
1938	10.6	20.1	86	8.2	6.4	9.9	.5	15.2	1.9	30.1	.6	.4	.7	48.4	52.0	11.8	89.7	181.3	82.3	42.8	13.1	87.2	59.7	22.1
1937	10.3	19.7	84	7.8	7.0	.9	.4	4.1	2.5	46.6	.6	.3	1.1	49.4	47.6	10.6	86.1	175.2	87.4	42.6	10.0	88.5	76.7	25.6
South Dakota:																								
1939	8.4	16.6	44	3.4	1.4	5.4	1.4	.8	2.5	24.7	.6	.6	.8	26.8	93.2	27.0	70.2	187.5	56.7	58.7	6.2	40.5	45.7	16.2
1938	6.7	16.7	47	3.0	1.4	.2	1.0	9.9	1.0	12.0	.4	1.2	.2	32.3	91.2	19.3	65.5	165.6	52.2	49.8	5.0	40.0	58.5	16.8
1937	9.1	16.8	53	4.4	.4	(6)	3.1	1.7	.6	48.5	.8	1.0	1.4	37.1	82.1	19.7	72.7	164.8	71.1	54.7	4.2	41.9	62.4	15.3
Tennessee:																								
1939	9.4	16.6	55	5.5	2.9	1.5	.6	3.2	1.6	35.7	.6	.7	.6	77.7	68.5	12.3	78.3	166.2	67.8	65.5	13.5	57.8	58.9	17.0
1938	9.5	16.7	66	5.8	3.6	8.9	.4	7.3	2.5	24.9	.7	.5	1.5	75.9	67.8	10.2	76.5	157.6	74.8	77.0	23.4	61.4	58.8	13.0
1937	10.2	16.7	64	6.8	4.8	1.0	.8	4.6	3.3	53.6	1.3	.6	2.6	84.0	66.0	10.7	76.8	156.2	92.0	77.0	19.8	63.9	65.9	22.6
Texas:																								
1939	8.9	17.4	67	5.0	4.7	1.6	.3	4.1	2.2	24.0	1.1	.3	.3	59.2	67.9	12.2	61.7	165.5	58.4	(7)	29.5	53.9	62.8	22.3
Utah:																								
1939	8.7	24.2	39	3.2	.5	.3	.3	1.0	.5	9.2	.5	1.0	.8	16.4	97.8	18.0	56.5	238.7	45.7	54.9	1.8	55.7	76.5	29.8
1938	9.0	25.6	42	3.7	.5	2.6	1.3	3.9	1.5	10.0	(6)	.3	1.8	22.1	87.4	18.8	51.4	228.3	57.9	60.7	2.3	51.9	93.8	35.7
1937	9.5	24.0	39	3.6	1.0	.8	1.6	3.4	1.3	27.8	1.6	1.0	1.3	21.1	92.0	20.4	54.9	228.8	63.9	68.0	2.8	56.4	89.4	33.5
Vermont:																								
1939	10.8	14.5	36	3.3	(6)	1.0	1.0	6.5	1.0	26.1	1.0	.3	.3	37.5	132.3	29.2	106.9	343.0	78.7	47.8	3.1	74.2	62.6	17.5
1938	10.4	14.8	42	3.0	.3	4.1	.3	3.1	4.5	13.2	1.4	.3	(6)	36.0	117.8	26.3	99.8	291.0	78.6	51.3	2.4	77.2	61.0	19.0
1937	11.2	14.5	48	3.9	1.4	(6)	.3	1.0	.7	37.0	.7	(6)	.7	50.6	138.2	21.6	112.8	322.9	98.4	52.7	3.5	72.3	67.7	15.4

Virginia:																								
1939	10.2	18.5	63	5.1	1.6	1.0	.3	5.8	2.6	23.3	.2	.2	.9	59.9	76.1	16.5	98.6	232.4	64.4	51.2	10.7	83.0	67.8	28.1
1938	10.4	18.8	72	5.2	2.2	4.3	.2	7.6	2.4	13.0	.3	.1	1.6	68.9	75.7	15.4	91.3	222.0	66.9	59.6	17.8	79.2	66.1	22.1
1937	10.8	18.5	66	5.1	1.9	2.9	.3	8.8	2.3	44.8	.4	.7	4.6	62.2	71.6	15.4	87.3	219.0	98.5	54.7	14.3	83.2	67.1	25.9
Washington:																								
1939	11.1	15.3	38	3.9	1.0	.8	.6	.2	.5	9.5	.6	1.6	.6	42.6	139.8	26.3	107.2	291.7	54.1	55.0	2.0	66.1	88.6	24.4
1938	10.9	15.6	57	3.5	1.0	.2	.6	2.5	.7	11.5	.1	1.4	.7	43.5	135.4	23.9	109.1	274.6	68.9	59.0	2.3	66.9	91.3	26.6
1937	11.5	14.7	40	5.1	.8	1.0	1.0	1.3	1.0	29.9	.5	2.0	1.4	47.3	130.4	23.8	102.9	295.5	70.4	54.7	2.3	74.8	97.2	31.4
West Virginia:																								
1939	8.8	19.9	55	3.6	3.1	.3	.9	2.0	1.9	20.9	.3	.7	2.0	44.6	71.6	15.8	75.1	165.2	60.4	59.2	15.7	63.8	71.3	15.8
1938	9.1	21.0	64	3.7	3.4	7.9	1.7	8.7	2.0	20.0	.9	.6	2.0	49.6	71.1	15.2	68.1	159.3	69.0	59.1	24.6	67.2	72.5	17.9
1937	10.0	21.0	64	5.5	3.4	1.4	1.6	13.5	3.1	47.8	1.2	.1	4.9	52.2	70.6	14.6	72.4	160.4	92.4	72.5	23.0	63.2	92.7	21.2
Wisconsin:																								
1939	10.8	18.1	42	2.8	1.8	.9	1.1	1.7	.1	22.2	.5	.2	.3	29.2	134.5	28.8	92.0	318.2	53.8	(7)	4.9	61.7	78.3	22.2
1938	10.2	15.4	42	2.9	.2	1.5	1.3	1.8	.4	6.8	.2	.4	.3	30.9	136.9	29.0	88.0	285.5	55.0	(7)	5.1	63.4	69.1	20.6
1937	11.1	18.0	44	5.0	.4	.1	2.6	1.8	.7	50.7	1.0	.5	.8	36.0	134.3	26.0	91.3	288.6	60.0	(7)	4.5	70.6	83.4	27.5
Wyoming:																								
1939	9.2	20.3	49	4.1	2.8	.6	(6)	.6	1.1	13.4	.6	(6)	1.1	24.6	82.2	12.9	61.0	219.8	48.7	67.7	4.5	69.9	110.8	44.2
1938	9.3	19.9	54	3.7	2.2	(8)	.6	16.4	1.7	16.4	(6)	.6	1.1	25.4	85.2	11.8	60.4	201.4	68.3	63.3	8.5	58.7	116.8	38.9
1937	10.9	19.2	52	3.8	.6	.6	5.1	5.1	(6)	58.6	4.0	1.7	2.8	18.8	73.4	9.1	82.5	260.0	124.6	74.5	14.2	44.0	135.4	53.5

[1] Includes all States with data for the 9-month period of 1937, 1938, and 1939. The District of Columbia is included as a State. Estimated population July 1, 1939: 119,832,000.

[2] These data are taken from the October 1938 and 1939 Statistical Bulletins published by the Metropolitan Life Insurance Co. All figures are provisional and are subject to correction, since they are based on provisional estimates of lives exposed to risk (17,700,000 persons in 1939). Data do not include all diseases reported to the Public Health Service.

[3] Excludes pericarditis, acute endocarditis, acute myocarditis, coronary artery diseases, and angina pectoris.

[4] Classified as diarrhea and enteritis, age not specified.

[5] Chronic nephritis (Bright's disease) only.

[6] No deaths reported.

[7] Data not available.

[8] Less than 0.1 per 100,000 population.

DEATHS DURING WEEK ENDED JANUARY 20, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Jan. 20, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,369	8,923
Average for 3 prior years	9,584	
Total deaths, first 3 weeks of year	28,335	27,247
Deaths under 1 year of age	557	501
Average for 3 prior years	552	
Deaths under 1 year of age, first 3 weeks of year	1,685	1,612
Data from industrial insurance companies:		
Policies in force	66,384,377	68,391,428
Number of death claims	15,167	14,814
Death claims per 1,000 policies in force, annual rate	11.9	11.3
Death claims per 1,000 policies, first 3 weeks of year, annual rate	10.0	9.7

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 3, 1940

Summary

A sharp increase in influenza occurred during the week ended February 3, with 17,641 cases reported as compared with 13,242 and 12,568 for the 2 preceding weeks and with 4,310 for the corresponding median week of the 5-year period 1935–39. The figures for the current week approach the total of 18,135 recorded in the peak week of 1939 (March 11).

A total of 65,597 cases of influenza has been reported for the first 5 weeks of 1940, as compared with 17,122 cases for the first 5 median weeks of the 5-year period 1935–39.

The highest incidence of the disease persists in the South Atlantic and South Central States, four of which States in these groups reported considerable increases during the current week, while others remained about the same or showed small variations. As compared with the preceding week, the largest increases in these areas were those for Texas (from 2,158 to 4,497 cases), Virginia (from 2,107 to 2,450 cases), Alabama (from 900 to 1,247 cases), and Oklahoma (from 373 to 724 cases).

Other areas reporting a significantly higher incidence are the East North Central, where the number of cases increased from 201 to 667, and the three Pacific States in which the number of cases rose from 708 to 1,955.

For the current week decreases were recorded for meningococcic meningitis, poliomyelitis, and typhoid fever, while diphtheria, measles, scarlet fever, smallpox, and whooping cough showed small increases. All of these eight diseases, however, with the exception of poliomyelitis, remained below the 5-year median (1935–39).

Telegraphic morbidity reports from State health officers for the week ended Feb. 3, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Feb. 3, 1940	Feb. 4, 1939		Feb. 3, 1940	Feb. 4, 1939		Feb. 3, 1940	Feb. 4, 1939		Feb. 3, 1940	Feb. 4, 1939	
NEW ENG.												
Maine	2	1	1	32	4	4	104	27	100	0	0	0
New Hampshire	0	0	0	------	------	------	16	1	34	0	1	0
Vermont	0	1	0	------	------	------	1	14	25	0	0	0
Massachusetts	4	4	4	------	------	------	292	775	513	0	0	2
Rhode Island	0	0	1	------	------	------	128	19	34	0	1	0
Connecticut	1	1	3	8	7	12	143	567	346	1	1	1
MID. ATL.												
New York [2]	27	26	39	[1] 19	[1] 159	[1] 28	254	908	908	1	7	12
New Jersey	10	8	15	42	56	35	34	27	156	1	3	3
Pennsylvania	43	60	51	------	------	------	86	222	643	5	10	6
E. NO. CEN.												
Ohio	18	40	40	118	------	122	21	22	150	2	2	7
Indiana	18	30	30	363	21	28	10	12	17	1	1	1
Illinois [2]	19	52	49	130	36	54	30	37	37	0	4	9
Michigan [3]	28	6	9	14	------	6	183	420	420	1	0	1
Wisconsin	1	0	2	42	68	68	230	789	789	0	0	1
W. NO. CEN.												
Minnesota	0	5	4	5	------	3	380	1,118	118	0	0	1
Iowa	1	8	8	11	1	12	72	170	45	0	0	2
Missouri	7	6	20	22	24	203	7	4	24	2	1	7
North Dakota	3	3	1	19	27	27	4	465	10	0	2	2
South Dakota	0	5	3	2	1	------	37	408	0	0	1	1
Nebraska	1	2	6	7	------	------	45	71	71	0	1	0
Kansas	4	5	8	143	6	29	329	11	18	0	0	1
SO. ATL.												
Delaware	0	0	1	------	------	------	3	0	83	0	0	0
Maryland [3]	8	4	7	119	61	61	5	1,046	149	0	0	0
Dist. of Col	9	8	7	24	5	4	0	18	13	0	0	4
Virginia	12	10	25	2,450	1,100	------	23	42	183	0	3	4
West Virginia	9	4	13	175	21	279	15	20	20	2	3	4
North Carolina	16	30	36	183	9	33	30	570	570	2	0	8
South Carolina [4]	3	17	11	1,674	772	772	5	18	40	2	2	2
Georgia [4]	6	8	8	1,104	131	259	46	97	0	1	1	2
Florida	5	11	12	20	------	10	30	61	27	0	1	1
E. SO. CEN.												
Kentucky	11	6	8	91	198	195	16	63	63	4	2	8
Tennessee [4]	8	9	14	370	58	172	74	42	25	1	3	4
Alabama [4]	7	12	15	1,247	259	301	41	90	90	0	5	3
Mississippi [3]	5	6	6	------	------	------	------	------	------	0	2	1
W. SO. CEN.												
Arkansas	17	9	5	1,587	159	159	28	104	14	1	1	1
Louisiana [4]	9	8	14	121	10	24	3	95	37	0	0	0
Oklahoma	13	9	10	724	162	190	0	135	48	0	1	2
Texas [4]	41	54	60	4,497	699	744	270	92	140	2	0	4
MOUNTAIN												
Montana	1	0	1	16	25	26	63	579	39	0	0	1
Idaho	0	0	0	2	1	6	125	28	29	0	1	0
Wyoming	2	0	0	4	------	------	5	94	6	0	1	1
Colorado	6	12	10	24	35	------	28	54	54	1	1	1
New Mexico	4	1	5	12	6	9	18	31	31	0	0	0
Arizona	12	2	2	288	68	125	4	8	9	1	1	0
Utah [3]	2	3	2	28	20	------	255	38	38	0	0	0
PACIFIC												
Washington	0	3	5	324	------	2	1,180	182	146	0	0	0
Oregon	4	2	2	191	25	59	163	35	35	2	1	1
California	24	34	34	1,440	76	131	428	1,954	311	1	1	3
Total	421	538	648	17,641	4,310	4,310	5,264	11,583	11,583	34	65	127
5 weeks	2,250	3,027	3,409	65,597	17,075	17,075	20,807	48,238	48,238	163	275	463

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended Feb. 3, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	Feb. 3, 1940	Feb. 4, 1939		Feb. 3, 1940	Feb. 4, 1939		Feb. 3, 1940	Feb. 4, 1939		Feb. 3, 1940	Feb. 4, 1939	
NEW ENG.												
Maine	0	0	0	19	18	19	0	0	0	0	0	1
New Hampshire	0	0	0	3	4	6	0	0	0	0	0	0
Vermont	0	0	0	20	1	21	0	0	0	0	0	0
Massachusetts	0	0	0	119	205	228	0	0	0	3	1	2
Rhode Island	1	0	0	0	7	15	0	0	0	0	0	0
Connecticut	0	0	0	77	107	93	0	0	0	8	0	0
MID. ATL.												
New York [3]	1	1	1	581	490	608	0	0	0	5	8	8
New Jersey	2	2	1	340	175	161	0	0	0	2	2	2
Pennsylvania	0	0	0	468	475	496	0	0	0	9	8	8
E. NO. CEN.												
Ohio	2	0	0	444	624	472	2	45	2	0	0	2
Indiana	0	0	0	[5] 206	253	220	4	118	5	2	1	1
Illinois [3]	2	2	1	579	583	684	2	5	6	8	3	4
Michigan [3]	0	0	0	208	574	474	0	4	1	0	1	3
Wisconsin	1	0	0	172	260	295	2	8	8	0	1	1
W. NO. CEN.												
Minnesota	0	0	0	136	136	137	13	17	9	0	0	1
Iowa	1	0	0	74	130	186	5	48	33	3	0	2
Missouri	0	0	0	53	115	163	2	12	12	1	0	3
North Dakota	0	0	0	52	24	40	0	1	7	0	0	0
South Dakota	0	0	0	25	20	29	6	11	11	0	0	0
Nebraska	0	0	0	25	42	70	0	3	8	0	0	0
Kansas	0	0	0	121	192	226	0	16	11	0	0	1
SO. ATL.												
Delaware	0	0	0	9	0	6	0	0	0	2	0	0
Maryland [3]	0	0	0	56	37	56	0	0	0	1	0	1
Dist. of Col	0	0	0	23	19	19	0	0	0	0	1	1
Virginia	0	1	0	37	40	40	0	0	0	3	5	6
West Virginia	0	1	1	54	50	46	0	2	0	0	0	2
North Carolina [4]	2	0	0	46	54	39	0	0	1	0	2	2
South Carolina [4]	1	3	1	4	16	8	0	1	0	3	1	2
Georgia	2	1	0	19	27	20	0	0	0	1	3	3
Florida	0	0	0	21	22	13	0	0	0	1	2	2
E. SO. CEN.												
Kentucky	0	1	1	77	88	76	0	3	0	0	1	2
Tennessee [4]	0	0	0	80	38	38	0	0	0	0	1	3
Alabama [4]	0	1	0	9	20	19	0	0	1	1	6	4
Mississippi [3]	1	1	1	10	12	12	0	1	1	2	3	2
W. SO. CEN.												
Arkansas	0	0	0	11	21	9	3	1	2	1	4	1
Louisiana [4]	0	1	0	15	20	16	0	1	1	5	9	6
Oklahoma	1	0	0	31	67	36	0	54	0	1	3	3
Texas [4]	0	0	0	80	113	113	5	38	7	6	14	11
MOUNTAIN												
Montana	0	0	0	52	20	60	0	2	9	0	1	1
Idaho	1	0	0	0	8	13	0	10	8	0	0	0
Wyoming	0	0	0	5	2	27	0	0	1	0	4	0
Colorado	2	1	0	66	46	84	20	6	5	0	0	1
New Mexico	0	0	0	30	9	24	0	1	1	0	0	3
Arizona	0	0	0	8	7	22	1	23	0	1	1	0
Utah [3]	0	0	0	28	38	72	1	0	0	1	0	0
PACIFIC												
Washington	1	1	1	54	89	89	0	8	12	2	5	3
Oregon	1	1	0	34	47	47	0	5	8	2	0	0
California	9	0	2	197	220	273	6	11	10	0	5	5
Total	31	18	21	4,868	5,601	6,207	72	455	313	74	96	118
5 weeks	182	85	106	[5] 21,356	26,182	20,701	391	2,003	1,457	403	554	589

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended Feb. 3, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, week ending— Feb. 3, 1940	Whooping cough, week ending— Feb. 4, 1939
NEW ENG.		
Maine	57	29
New Hampshire	2	10
Vermont	23	90
Massachusetts	144	225
Rhode Island	17	37
Connecticut	74	84
MID. ATL.		
New York [1]	439	305
New Jersey	93	388
Pennsylvania	372	630
E. NO. CEN.		
Ohio	205	170
Indiana	45	23
Illinois [2]	91	352
Michigan [3]	120	232
Wisconsin	175	203
W. NO. CEN.		
Minnesota	52	65
Iowa	4	19
Missouri	19	28
North Dakota	26	33
South Dakota	5	24
Nebraska	6	1
Kansas	36	21
SO. ATL.		
Delaware	2	3
Maryland [3]	127	28
Dist. of Col.	9	31
Virginia	62	39
West Virginia	7	30
SO. ATL.—Contd.		
North Carolina	53	313
South Carolina [4]	17	73
Georgia [4]	13	26
Florida	9	36
E. SO. CEN.		
Kentucky	63	23
Tennessee [4]	27	54
Alabama [4]	22	8
Mississippi [3]		
W. SO. CEN.		
Arkansas	1	24
Louisiana [4]	22	5
Oklahoma	1	1
Texas [4]	107	113
MOUNTAIN		
Montana	1	14
Idaho	2	3
Wyoming	22	2
Colorado	50	45
New Mexico	45	9
Arizona	9	17
Utah [3]	139	17
PACIFIC		
Washington	35	39
Oregon	20	29
California	194	117
Total	3,073	4,246
5 weeks	13,478	21,705

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended Feb. 3, 1940, 2 cases, as follows: New York, 1; Illinois, 1.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended Feb. 3, 1940, 27 cases, as follows: South Carolina, 2; Georgia, 8; Tennessee, 2; Alabama, 4; Louisiana, 1; Texas, 10.
[5] A later report increases to 189 the total reported cases of scarlet fever in Indiana for the week ended Jan. 27, Public Health Reports dated Feb. 2, 1940, p. 217.

BUBONIC PLAGUE IN UTAH

One case of bubonic plague was reported under date of February 6, 1940, by Dr. William M. McKay, Acting State Health Commissioner of Utah. The case, moderately severe, in a 29-year-old patient, is stated to have had its onset on December 4, 1939, and probably to have been contracted in skinning a coyote.

WEEKLY REPORTS FROM CITIES

City reports for week ended January 20, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	193	1,324	154	2,816	1,027	1,828	41	379	20	1,188	--------
Current week [1]	112	1,190	92	797	642	1,195	1	295	19	803	--------
Maine:											
Portland	0	------	0	11	1	0	0	0	0	7	35
New Hampshire:											
Concord	0	------	1	0	1	0	0	0	0	0	10
Manchester	0	------	0	1	5	2	0	0	0	0	35
Nashua	0	------	0	11	0	2	0	0	0	0	4
Vermont:											
Barre	0	------	0	0	0	0	0	0	0	0	2
Burlington	0	------	0	0	0	0	0	0	0	2	12
Rutland	0	------	0	0	0	0	0	0	0	0	6
Massachusetts:											
Boston	2	------	0	18	14	45	0	8	1	44	239
Fall River	2	------	0	1	4	1	0	0	0	12	33
Springfield	0	------	0	1	2	1	0	1	0	13	43
Worcester	0	------	0	0	10	4	0	1	1	0	55
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	14
Providence	0	2	1	119	6	6	0	0	0	12	67
Connecticut:											
Bridgeport	0	------	0	0	0	4	0	0	0	0	39
Hartford	4	------	0	1	3	4	0	3	0	8	69
New Haven	0	1	0	4	3	3	0	2	0	3	48
New York:											
Buffalo	0	------	0	1	15	16	0	5	0	3	177
New York	30	19	2	26	92	249	0	53	6	100	1,598
Rochester	0	------	0	0	3	7	0	0	0	14	66
Syracuse	0	------	0	0	5	4	0	1	0	25	55
New Jersey:											
Camden	2	1	2	1	4	16	0	1	0	0	37
Newark	0	7	1	5	8	18	0	8	0	16	116
Trenton	0	------	1	1	4	3	0	3	0	0	33
Pennsylvania:											
Philadelphia	4	22	5	11	38	63	0	24	0	54	614
Pittsburgh	3	16	10	3	20	26	0	5	0	13	208
Reading	0	------	1	1	9	0	0	1	0	3	45
Scranton	0	1	--------	0	-------	4	0	-------	0	6	--------
Ohio:											
Cincinnati	7	1	3	3	5	15	0	7	0	15	133
Cleveland	1	24	2	1	12	41	0	4	0	44	183
Columbus	4	2	2	0	7	8	0	4	0	7	102
Toledo	1	------	0	1	4	15	0	3	0	7	64
Indiana:											
Anderson	0	------	0	0	3	7	0	0	0	0	11
Fort Wayne	0	------	0	0	1	0	0	0	0	1	28
Indianapolis	6	------	1	2	9	25	0	6	0	5	110
Muncie	0	------	0	0	3	1	0	0	0	0	16
South Bend	0	------	0	0	1	2	0	0	0	5	19
Terre Haute	0	------	0	0	4	1	0	0	0	0	35
Illinois:											
Alton	0	1	1	0	3	3	0	0	0	0	14
Chicago	10	13	2	19	54	218	0	20	1	34	766
Elgin	0	------	0	0	1	5	0	0	0	0	9
Moline	0	1	0	2	0	3	0	0	0	0	11
Springfield	------	------	--------	-------	-------	-------	-------	-------	-------	--------	--------
Michigan:											
Detroit	6	1	0	7	18	89	0	12	0	27	283
Flint	0	------	0	0	3	15	0	0	0	12	34
Grand Rapids	0	------	0	1	3	26	0	0	0	10	48
Wisconsin:											
Kenosha	1	------	0	0	1	6	0	0	0	1	8
Madison	0	------	0	1	1	2	0	0	0	6	6
Milwaukee	0	1	1	2	5	25	0	4	0	4	92
Racine	0	------	0	0	0	2	0	0	0	2	12
Superior	0	------	0	0	0	6	0	0	0	0	6

[1] Figures for Springfield, Ill., Wilmington, N. C., and Seattle, Wash., estimated; reports not received.

City reports for week ended January 20, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Minnesota:											
Duluth	0	------	0	134	0	2	0	1	0	6	26
Minneapolis	0	------	1	1	11	31	0	1	0	10	108
St. Paul	0	------	0	1	5	15	0	1	0	34	54
Iowa:											
Cedar Rapids	1	------	------	13	------	1	0	------	0	1	------
Davenport	0	------	------	2	------	5	0	------	0	0	------
Des Moines	1	------	0	13	0	23	0	0	0	0	34
Sioux City	0	------	------	0	------	6	0	------	0	0	------
Waterloo	0	------	------	0	------	2	0	------	0	0	------
Missouri:											
Kansas City	1	------	0	1	15	10	0	1	0	0	103
St. Joseph	0	------	0	0	2	1	0	0	0	0	16
St. Louis	0	1	1	0	15	19	1	3	1	9	205
North Dakota:											
Fargo	0	------	0	0	1	1	0	0	0	2	7
Grand Forks	0	------	------	2	------	0	0	------	0	7	------
Minot	0	------	0	0	0	0	0	0	0	0	5
South Dakota:											
Aberdeen	0	------	------	1	------	3	0	------	0	3	------
Sioux Falls	0	------	0	0	0	1	0	0	0	0	9
Nebraska:											
Lincoln	0	------	------	1	------	1	0	------	0	0	------
Omaha	0	------	1	1	14	1	0	3	0	0	61
Kansas:											
Topeka	0	3	3	0	2	6	0	0	0	0	19
Wichita	0	7	0	149	9	3	0	1	0	1	43
Delaware:											
Wilmington	0	------	0	2	3	5	0	0	0	1	36
Maryland:											
Baltimore	4	37	3	2	24	9	0	16	1	76	275
Cumberland	0	1	2	1	3	2	0	0	0	0	19
Frederick	0	------	0	0	0	0	0	0	0	0	1
Dist. of Col.:											
Washington	0	9	3	7	19	21	0	8	0	8	177
Virginia:											
Lynchburg	0	------	0	0	0	0	0	1	0	1	21
Norfolk	0	18	0	1	6	4	0	1	0	0	33
Richmond	0	------	0	0	10	2	0	0	0	1	78
Roanoke	0	------	0	0	3	2	0	0	0	13	17
West Virginia:											
Charleston	0	------	0	0	1	0	0	0	0	0	19
Wheeling	0	------	0	0	1	1	0	0	0	1	21
North Carolina:											
Gastonia	2	1	0	0	0	0	0	0	0	0	1
Raleigh	0	------	0	0	1	1	0	3	0	3	20
Wilmington	------	------	------	------	------	------	------	------	------	------	------
Winston-Salem	0	------	0	0	1	1	0	1	0	0	23
South Carolina:											
Charleston	0	534	1	0	5	3	0	0	3	0	24
Florence	0	4	1	0	4	0	0	0	0	0	8
Greenville	0	------	0	0	0	0	0	0	0	0	3
Georgia:											
Atlanta	3	235	1	7	6	5	0	4	0	4	78
Brunswick	0	------	0	2	1	3	0	0	0	0	3
Savannah	2	106	7	0	2	2	0	2	0	1	43
Florida:											
Miami	0	4	1	1	1	0	0	1	0	2	41
Tampa	1	4	3	4	2	1	0	1	0	0	30
Kentucky:											
Ashland	0	1	0	0	0	0	0	0	0	2	7
Covington	0	------	0	0	2	2	0	3	0	0	20
Lexington	1	------	0	0	0	2	0	3	0	1	18
Louisville	2	6	0	6	14	13	0	1	0	51	87
Tennessee:											
Knoxville	0	5	1	0	4	4	0	0	0	0	28
Memphis	1	21	1	3	10	20	0	7	0	11	117
Nashville	0	------	4	10	6	0	0	2	0	2	56
Alabama:											
Birmingham	0	16	6	0	4	2	0	5	2	1	68
Mobile	0	18	2	0	2	3	0	1	0	0	32
Montgomery	0	12	------	10	------	1	0	0	------	0	------
Arkansas:											
Fort Smith	0	8	------	0	------	0	0	------	0	0	------
Little Rock	0	10	0	0	2	3	0	1	0	0	12
Louisiana:											
Lake Charles	0	------	0	0	0	1	0	0	0	0	2
New Orleans	3	3	4	0	31	9	0	11	2	11	206
Shreveport	0	------	0	1	5	0	0	0	0	0	30

City reports for week ended January 20, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Oklahoma:											
Oklahoma City	0	----	0	2	5	2	0	1	0	0	42
Tulsa	1	------	------	0	------	0	0	------	0	5	------
Texas:											
Dallas	1	2	2	2	1	8	0	0	0	6	70
Fort Worth	1	------	0	0	4	4	0	1	0	1	38
Galveston	0	------	0	0	2	1	0	0	0	0	16
Houston	3	------	1	1	10	4	0	3	0	0	90
San Antonio	0	------	1	87	5	0	0	5	0	0	74
Montana:											
Billings	0	------	0	0	3	0	0	0	0	0	6
Great Falls	0	------	0	0	1	2	0	0	0	0	8
Helena	0	------	0	0	0	0	0	0	0	0	1
Missoula	0	------	0	0	0	2	0	0	0	5	2
Idaho:											
Boise	0	------	0	0	0	0	0	0	0	0	4
Colorado:											
Colorado Springs	0	------	0	2	0	1	0	0	0	0	19
Denver	9	------	1	4	5	8	0	2	0	3	82
Pueblo	0	------	0	0	1	1	0	0	0	4	9
New Mexico:											
Albuquerque	1	------	0	1	1	1	0	0	0	5	9
Utah:											
Salt Lake City	0	------	2	22	1	6	0	2	0	56	36
Washington:											
Seattle	------	------	------	------	------	------	------	------	------	------	------
Spokane	0	3	2	0	0	8	0	0	0	4	39
Tacoma	0	------	0	121	1	7	0	2	0	0	40
Oregon:											
Portland	1	16	1	55	6	6	0	0	0	4	98
Salem	0	------	------	7	------	0	0	------	0	0	------
California:											
Los Angeles	0	66	5	15	12	10	0	21	0	14	359
Sacramento	2	1	0	3	4	0	0	1	1	2	28
San Francisco	0	3	0	3	6	8	0	7	0	8	182

State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Poliomyelitis cases	State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Poliomyelitis cases
Massachusetts:				**Iowa:**			
Boston	0	0	1	Sioux City	1	0	0
New York:				**District of Columbia:**			
New York	2	1	0	Washington	0	0	1
Pennsylvania:				**Georgia:**			
Philadelphia	0	0	1	Atlanta	1	0	0
Pittsburgh	1	1	0	**Colorado:**			
Scranton	0	1	0	Colorado Springs	0	0	1
Ohio:				**Oregon:**			
Columbus	1	2	0	Portland	0	1	0
Indiana:				**California:**			
Anderson	0	0	1	Los Angeles	0	0	1
Illinois:				Sacramento	1	0	0
Chicago	1	0	0				
Wisconsin:							
Milwaukee	1	1	0				

Encephalitis, epidemic or lethargic. Cases: Bridgeport, 1; New York, 2; Great Falls, 1; San Francisco, 1.
Pellagra.—Cases: Boston, 1; Charleston, S. C., 3; San Francisco, 1.
Typhus fever.—Cases: Savannah, 1; Mobile, 1; Montgomery, 1; New Orleans, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 23, 1939.—During the week ended December 23, 1939, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada, as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis					1					1
Chickenpox		19		252	270	72	30	11	23	677
Diphtheria			10	32	1	10	5			58
Influenza		1			5	1			10	17
Measles				149	103	16	101	5	16	390
Mumps				39	122	7	17		4	189
Pneumonia		5			28				5	38
Poliomyelitis				1	1					2
Scarlet fever	3		8	86	162	8	16	28	15	326
Tuberculosis		2	8	62	37		1			110
Typhoid and paratyphoid fever				12	1	1				14
Whooping cough				40	60	43	29	4	7	183

ITALY

Communicable diseases—4 weeks ended November 5, 1939.—During the 4 weeks ended November 5, 1939, cases of certain communicable diseases were reported in Italy as follows:

Disease	Oct. 9-15	Oct. 16-22	Oct. 23-29	Oct. 30-Nov. 5
Anthrax	19	16	19	20
Cerebrospinal meningitis	11	10	16	15
Chickenpox	55	84	113	82
Diphtheria	650	646	708	753
Dysentery (amoebic)	14	21	14	5
Dysentery (bacillary)	12	9		4
Hookworm disease	15	18	36	15
Lethargic encephalitis		1		1
Measles	216	286	287	317
Mumps	85	90	89	76
Paratyphoid fever	133	159	94	120
Pellagra		2	1	
Poliomyelitis	159	161	128	95
Puerperal fever	32	25	30	25
Rabies	1			1
Scarlet fever	196	259	204	282
Typhoid fever	1,008	983	767	667
Undulant fever	44	41	27	31
Whooping cough	236	301	271	201

SWEDEN

Notifiable diseases—October 1939.—During the month of October 1939, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	6	Poliomyelitis	129
Diphtheria	7	Scarlet fever	3,114
Dysentery	9	Syphilis	31
Epidemic encephalitis	6	Typhoid fever	6
Gonorrhea	1,038	Undulant fever	5
Paratyphoid fever	21	Weil's disease	10

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of January 26, 1940, pages 182-186. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Paauhau Area.—A rat found on January 3, 1940, in Paauhau area, Hamakua District, Island of Hawaii, T. H., has been proved positive for plague.

Peru.—Plague has been reported in Peru as follows: October 1939, Cajamarca Department, 2 cases; Lambayeque Department, 1 case; Lima Department, 5 cases, 2 deaths. November 1939, Lambayeque Department, 2 cases, 2 deaths; Libertad Department, 1 case; Lima Department, 5 cases, 5 deaths; Piura Department, 3 cases.

United States—Utah.—Report of a case of bubonic plague in Utah appears on page 258 of this issue of the PUBLIC HEALTH REPORTS.

Yellow Fever

Cameroon—Nkongsamba.—On January 22, 1940, 1 suspected case of yellow fever was reported in Nkongsamba, Cameroon.

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Public Health Reports

VOLUME 55 FEBRUARY 16, 1940 NUMBER 7

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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PREVALENCE OF DISEASE

Public Health Reports

Vol. 55 • FEBRUARY 16, 1940 • *No. 7*

PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

December 31, 1939-January 27, 1940

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the PUBLIC HEALTH REPORTS under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended January 27, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935-39.

DISEASES ABOVE MEDIAN PREVALENCE

Influenza.—For the country as a whole, the reported cases of influenza for the 4 weeks ended January 27 totaled 47,956, which was almost four times last year's figure for the corresponding period, which figure (12,765) also represents the 1935-39 average incidence for this period. The highest incidence is still reported from the South Atlantic, South Central, and Western regions. In the North Atlantic and North Central regions the numbers of cases appear to be about normal for this season of the year. While some States in which the disease has been unusually prevalent showed a decline during the last week of the period under consideration, the only region as a whole to show a decline was the Mountain region. There the cases dropped from approximately 6,000 for the preceding 4-week period to approximately 2,400 during the current period. With the exception of the year 1937, the current incidence is the highest recorded during this period since 1933.

The mortality rate for large cities rose from 11.2 per 1,000 population (annual basis) for the 4 weeks ended December 30 to 12.7 for the 4 weeks ended January 27, 1940. The average rate for the corresponding period in the years 1934-36, 1937, and 1938 was 12.9. The current rise is no doubt due in part to the increase of influenza cases. The rate is, however, only slightly above that for the corresponding period in each of the 2 preceding years.

Poliomyelitis.—The poliomyelitis incidence again declined, from 265 cases for the preceding 4-week period to 151 cases for the 4 weeks ended January 27. Compared with preceding years the incidence still maintained an increase of approximately 70 percent over the average seasonal level. In each section the number of cases was higher than the 1935–39 median figure for this period. The lowest incidence of this disease is usually reached during March or April.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period Dec. 31, 1939–Jan. 27, 1940, the number for the corresponding period in 1939, and the median number of cases reported for the corresponding period in 1935–39 [1]

Division	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median
	Diphtheria			Influenza [2]			Measles [3]			Meningococcus meningitis		
United States [1]	1,829	2,491	2,701	47,950	12,765	12,765	15,635	36,655	36,655	120	212	377
New England	53	65	65	124	50	118	2,583	2,994	3,472	7	6	11
Middle Atlantic	230	360	455	155	362	362	1,265	5,143	5,143	33	47	62
East North Central	351	517	614	602	398	621	2,371	3,634	3,634	21	22	79
West North Central	119	225	247	1,079	321	919	1,976	7,239	6,112	9	13	31
South Atlantic	420	514	517	25,134	5,419	5,419	564	5,098	5,098	20	46	77
East South Central	174	171	221	5,278	1,187	2,281	421	900	900	21	36	66
West South Central	297	377	422	10,968	3,856	3,856	883	1,482	998	3	16	30
Mountain	73	119	93	2,383	761	761	1,126	2,427	1,579	8	17	19
Pacific	112	143	157	2,143	411	644	4,426	7,738	1,079	7	9	16
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States [1]	151	67	85	16,487	20,581	23,787	320	1,548	1,144	329	458	464
New England	4	1	1	917	1,134	1,661	0	0	0	19	13	14
Middle Atlantic	13	2	8	4,190	4,059	5,556	0	0	0	57	82	72
East North Central	16	11	11	5,490	8,142	8,170	59	543	194	45	44	52
West North Central	20	7	7	1,891	2,593	3,676	122	450	450	16	39	17
South Atlantic	18	19	0	1,287	1,141	1,183	8	13	13	55	92	91
East South Central	10	7	7	629	666	620	0	20	16	12	38	40
West South Central	14	9	9	533	734	734	47	178	44	71	104	104
Mountain	14	1	2	569	631	900	64	212	166	33	26	24
Pacific	42	10	15	981	1,481	1,481	20	132	132	18	20	32

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 41 States and New York City.
[3] 47 States. Mississippi is not included.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—The incidence of diphtheria was the lowest for this period in the 12 years for which these data are available, and was possibly the lowest for all time. Reported cases for the 4 weeks ended January 27 numbered 1,829, as compared with 2,491 for the corresponding period in 1939, and with an average of approximately 2,800 cases in the years 1935–39. The decline occurred in all regions.

Measles.—The number of reported cases (15,635) of measles was also the lowest recorded for this period in recent years. During the corresponding period in 1939 the cases totaled 36,655, which figure also represents the 1935–39 average incidence for the period. The

incidence was comparatively low in all sections of the country except the Pacific region, where the number of cases was more than four times the 1935-39 median incidence for this period.

Meningococcus meningitis.—The incidence of meningococcus meningitis was also relatively low, 129 cases, as compared with 212, 377, and 542 cases for the corresponding period in 1939, 1938, and 1937, respectively. For the country as a whole the current incidence is the lowest for this period in the 12 years for which these data are available.

Scarlet fever.—The number of cases (16,487) of scarlet fever reported for the current period was only about 80 percent of the number recorded for the corresponding period in 1939, and about 70 percent of the 1935-39 median figure (23,787) for this period. In the South Atlantic and East South Central regions the incidence was at approximately the average level of recent years, but in all other sections the incidence was relatively low. In all regions except the Middle Atlantic, South Atlantic, and East South Central the incidence was the lowest in recent years.

Smallpox.—Smallpox remained at a comparatively low level. The number of cases reported for the current period was 320, as compared with 1,548, 2,435, and 1,144 for the corresponding period in 1939, 1938, and 1937, respectively. Each region of the country shared in the favorable situation of this disease that now exists. Very significant decreases were reported from the Central and Western regions, where smallpox has been unusually prevalent in certain States during the past three years.

Typhoid fever.—For the country as a whole the typhoid fever incidence (329 cases) was about 70 percent of the average (464 cases) seasonal incidence. The New England and Mountain regions reported a few more cases than might normally be expected, but in all other regions the incidence was relatively low. For this disease, also, the current incidence is the lowest for this period in the 12 years for which these data are available.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended January 27, based on data received from the Bureau of the Census, was 12.7 per 1,000 population (annual basis). The rate for the years 1935–39 was 13.6; the average rate for that period exclusive of 1937, a year in which influenza was unusually prevalent, is 12.9. Considering the rather high incidence of influenza the current mortality rate is, therefore, about normal.

LIMITATIONS OF EUGLENIDAE AS POLLUTED WATER INDICATORS

By JAMES B. LACKEY, *Cytologist*, and RUSSELL S. SMITH, *Associate Sanitary Engineer, United States Public Health Service, Stream Pollution Investigations, Cincinnati, Ohio*

Casual inspection of many of the streams of this country gives the impression that they might be suitable for fishing, bathing, public water supplies, stock-watering, boiler water supplies, or some of the myriad uses to which relatively pure waters can be put. Tracing the stream courses may reveal, however, that even those streams which look the best are heavily polluted by domestic sewage, cannery wastes, paper mill wastes, distillery wastes, or other injurious substances and that such flowing waters are largely useless or even harmful to man and his cattle, empty of fish, and shunned by waterfowl. Many of the streams of the eastern United States are vastly changed from what they were two or three generations ago and an awakening public interest in their decreasing economic, public health, recreational, and esthetic values is demanding that those responsible for stream abuse, whether cities, corporate interests, or private individuals, be compelled to stop such abuse, with its injurious effects upon the population at large.

Criteria of stream pollution may be all too evident in turbid, highly colored, offensive smelling streams. But for relatively clear, sparkling streams laboratory examination is often needed to determine the nature and extent of pollution. This examination is a public service usually performed by skilled scientific city, State, or Federal personnel. Chemical, bacteriological, and biological determinations of the sanitary conditions of waters are made in the laboratory.

Biological examinations may include several features, such as the microscopic life present or the animals living in or on the bottom of the stream. It has been stated that an abundance of certain microscopic organisms is a sure indication of organic pollution, usually with domestic sewage. One of the groups of such organisms used for this purpose has been the "*Euglenas* and their allies," a related group of green flagellates belonging to the lowest plant or animal classifications, the Algae or Protozoa, but difficult to place categorically in either because the organisms include some of the characteristics of each group. Kolkwitz and Marsson (*1*), Marsson (*2*), and Fair and Whipple (*3*) refer to the Euglenidae as indicators of pollution in the above manner.

EUGLENIDAE IN THE SCIOTO RIVER

Between April 1937 and November 1938, the senior author examined 884 samples taken from the Scioto River in south central Ohio. Samples were taken from as many as 18 stations along the

river and tributary creeks, and for the greater part of the time each point was sampled weekly. Half the samples were examined after formalin preservation and half as fresh unpreserved samples. Usually

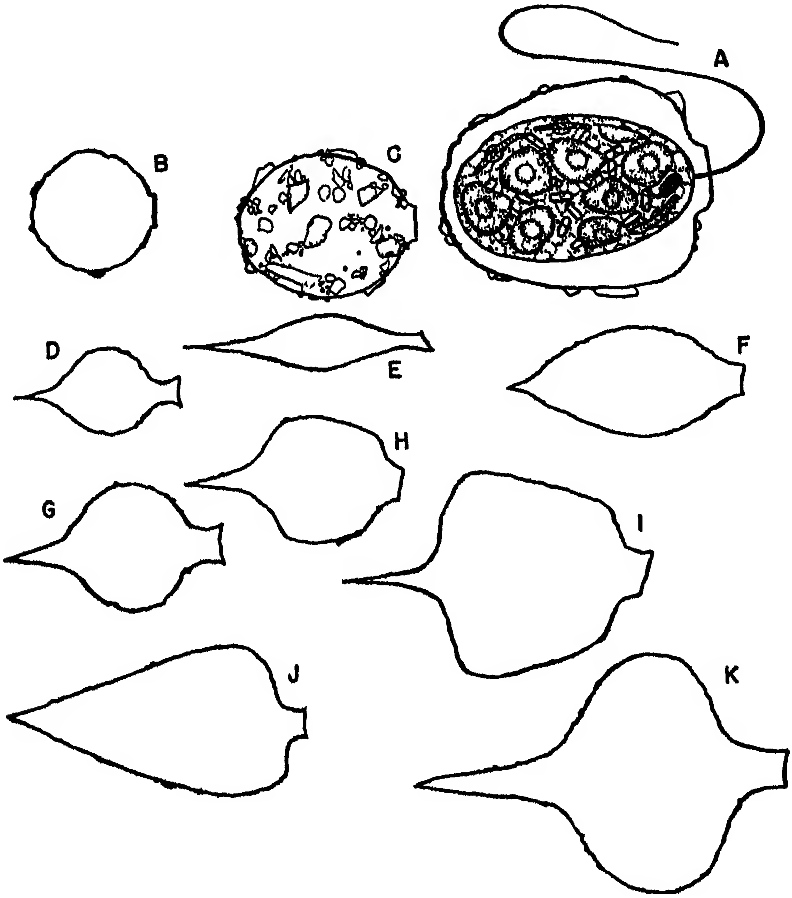

FIGURE 1 Forms of *Trachelomonas* included in this paper under the species *urceolata*. In the Scioto River there is a completely intergrading series of these forms, all of them with a rough, thin, colorless shell to which sand and debris is attached.

(*A*) Diagrammatic view of the most common form showing type of chloroplast with central pyrenoid, location of stigma, and nature of paramylum. Note the encrusted shell with short neck, broadly rounded anteriorly.

(*B*) Shell type, near *T. scabra*.

(*C*) Shell showing nature of granular deposits.

(*D*)-(*K*) Series of intergrading forms. Any one of these might be identified as a distinct species or variety.

100 milliliters of river water were centrifuged until the suspended matter had been concentrated in a small amount of catch. All organisms were identified, if possible, and counted. The Scioto at times has a very large plankton content, but ample time was devoted

to the critical examination and enumeration of catches so that the nature and extent of the plankton population is very accurately known.

Five genera of green Euglenidae were found, comprising 48 species. In addition one group of *Euglena* and one of *Trachelomonas* were called simply "species," inasmuch as specific determinations were not possible. One group of several possible species of *Trachelomonas* was called *T. urceolata* (fig. 1) since it comprised a large intergrading series of forms. Total numbers of each recognizable species were tabulated for each station examined on a given date; then a separate sheet was made for each species showing the date of sampling and the

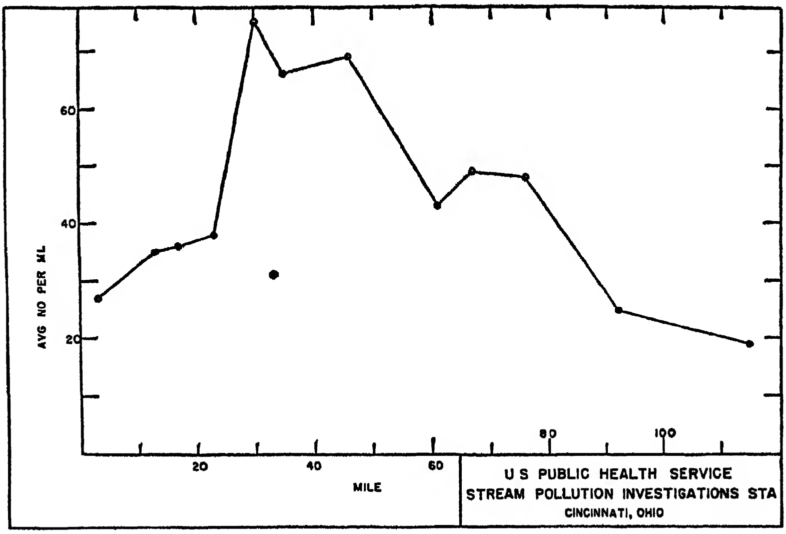

FIGURE 2—Average number per ml of green Euglenidae, exclusive of *Euglena viridis*, at Scioto River sampling stations, April 1937 December 1938

numbers of that species present per milliliter of raw river water. This enabled one to determine almost at a glance whether that species had a seasonal or all-year distribution, how it was affected by rises in the river, and the time and place of its maximum occurrences.

Figure 2 shows the average numbers of green Euglenidae per milliliter at each station examined during 19 months. Figure 3 shows their seasonal distribution at mile 30 (Red Bridge), approximately 23 miles below the Columbus sewage outfall. From these two charts it is at once evident that the average number of green Euglenidae is high for the 76-mile stretch from Columbus to Kilgour Bridge, and that they show a pronounced seasonal distribution.

The first sampling point, mile 3, is just downstream from a low head dam at Columbus and the river there is unpolluted, receiving no sewage and being only a few miles below the Griggs and O'Shaughnessy

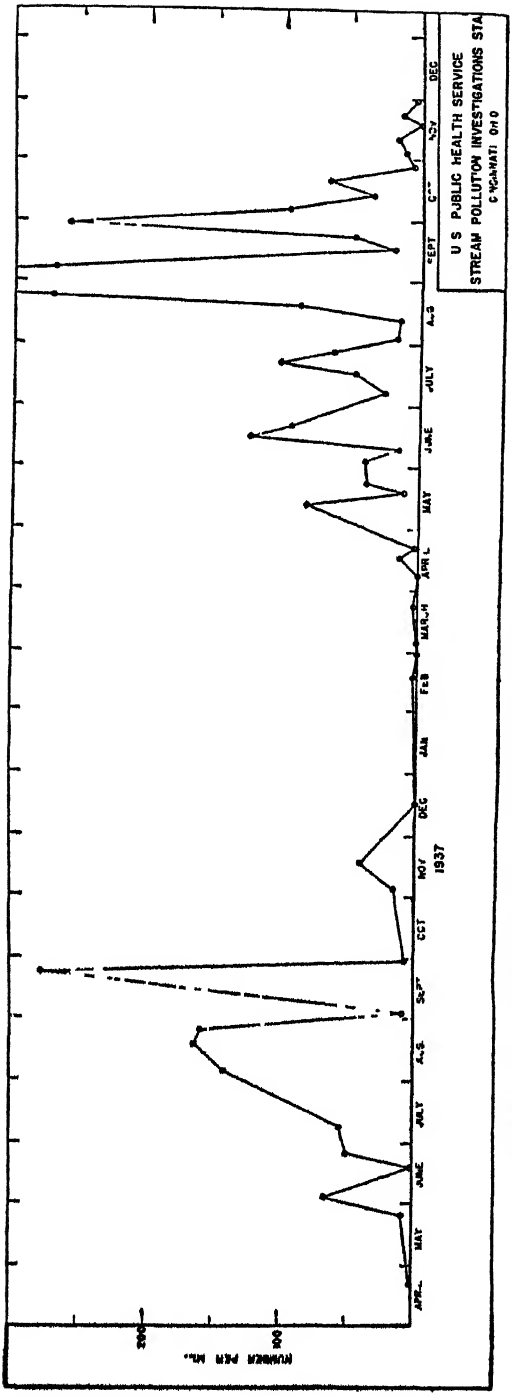

FIGURE 3.—Numbers of all green Euglenidae at mile 30 (Red Bridge) in the Scioto River, April 1937–December 1938

reservoirs. At about mile 7 it receives the discharge of the Columbus sewage treatment plant, which during 1937 and 1938 poured a poorly treated effluent into the river. During the summer low water stages the river was visibly foul at least as far as mile 17. Much of this stretch was a region of slow flow, through pools separated by shallow riffles, offering an excellent chance for the rapid multiplication of plankton during low water, warm weather conditions. From about mile 17 a steady improvement in the condition of the river was noticeable and this visual evidence was supported by chemical and bacteriological findings Certainly the river was not grossly polluted at mile 30 (Red Bridge) nor did it get sufficient sewage or waste materials at any point below to deteriorate the water markedly.

The zone in which the Euglenidae were most abundant during the 2 years was not the most foul water zone, but from mile 30 to mile 76 downstream. One sharp decrease in numbers occurred at mile 32, but there was an immediate rise and at this time there is no indication of what factor was responsible for the decrease here. In other words, the greatest numbers of green Euglenidae in the Scioto occur in the zone in which recovery from heavy pollution is taking place, and the decrease in numbers at mile 32 is a minor fluctuation.

Of course, the Scioto is a flowing stream and, because of the time element, enormous numbers of Euglenidae should not be expected at the precise point where it becomes heavily polluted by Columbus sewage, even if Euglenidae react favorably to sewage by multiplying rapidly. Des Cilleuls (*4*) has summarized the findings of many workers showing that plankton multiplication is rapid and most favored in still areas of streams such as bays, dead arms, and the like, and that these feed a constant supply of plankton into the current. There are numerous still areas in the Scioto within the heavily polluted stretch, and examination of samples from such points failed to reveal them as "breeding places" for Euglenidae. Weston and Turner (*5*) long ago pointed out that a sewage-polluted stream recovers biologically before it recovers chemically. At Red Bridge chemical recovery of the Scioto is generally very evident; hence biological recovery would be expected above this point. Actually, the increase of Euglenidae is slow between mile 7 and mile 23 (fig. 2), but rises sharply thereafter and remains high. If the stimulus to this high development is derived from pollution, either it is a very sustained one or it is due to some substance or condition not shown by chemical analysis.

If we examine individual species, most of them have their maximum occurrence in the recovery zone, even if their numbers are small. Some species, such as *Cryptoglena pigra, Euglena fusca,* or *Phacus anacoleus,* showed few numbers most of the time, but sometimes flared up suddenly into numbers somewhat comparable to the familiar blooms of *Euglenas* occasionally seen on ponds or temporary pools.

Others, such as *Euglena oxyuris* or *Trachelomonas volvocina*, were present most of the time over widely scattered mileages, but never attained large numbers. Still others, as *Euglena pisciformis*, *E. viridis*, *Trachelomonas crebea*, and *T. urceolata*, were common in occurrence much of the time. Figure 4 shows the average distribution of *E viridis* in the Scioto during the period studied. The increase in numbers of *E. viridis* in the grossly polluted zone is striking compared to the behaviour of the Euglenidae as a whole. But the increase is short lived, for there is a decrease between mile 13 and mile 23, which allows a time interval when multiplication might be possible, or expected, if sewage provides a stimulus. Furthermore, the greatest

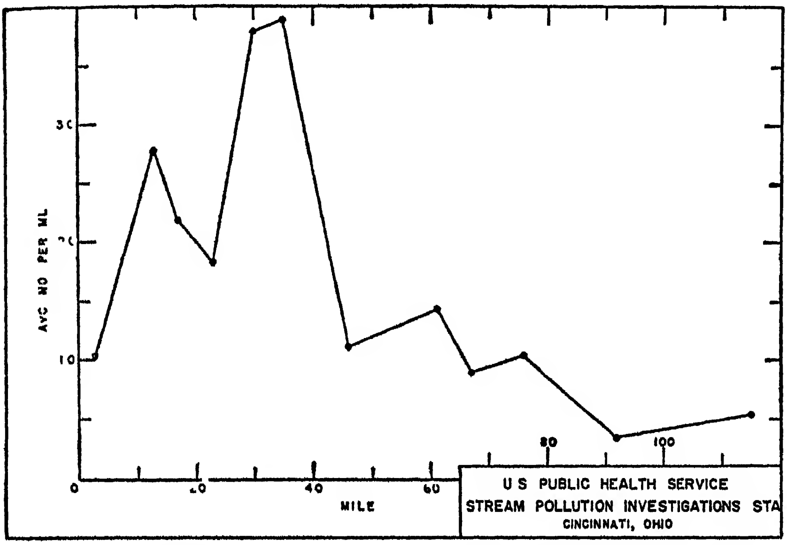

FIGURE 4. Average number per ml of *Euglena viridis* at Scioto River sampling stations, April 1937–December 1938

numbers of *E. viridis* are in the cleaner waters between miles 30 and 40. For this particular species the data certainly suggest a favorable reaction to waters recently foul with organic matter.

Figure 5 shows a similar reaction for the group of Trachelomonads grouped as *T urceolata*. But there is an initial decrease for these organisms where pollution is heaviest, and recovery in numbers is slow until past mile 23.

Of the individual species of Euglenidae whose total numbers and wide distribution are sufficient for critical use, *E. viridis* comes nearest to indicating a preference for polluted water, and yet even its maximum and greatest occurrence is in the recovery zone. Figure 5 shows a much greater average occurrence of *T. urceolata* in the zone still further down.

If any individual set of samples is selected for analysis, false conclusions may easily be drawn. Table 1 shows a few instances of the

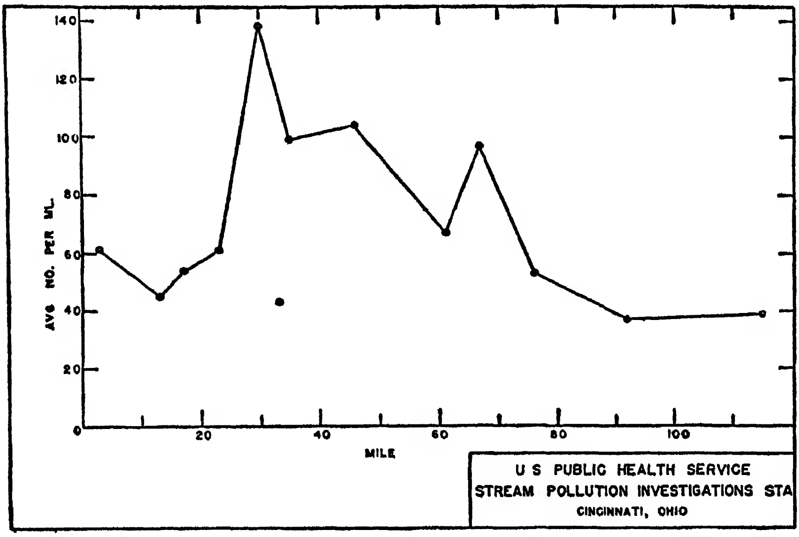

FIGURE 5.—Average number per ml. of *Trachelomonas urceolata* group at Scioto River sampling stations, April 1937–December 1938.

distribution of certain species on certain dates, with maxima for the same species at one time in the zone of greatest pollution, at another

TABLE 1.—*Distribution of various Euglenidae in the Scioto River on certain dates. Numbers per milliliter of raw water*

Species	Dates	Sanitary condition of water																		
		Clean	Polluted			Transitional			Clean											
		Sampling stations in river miles below Columbus, Ohio																		
		3	13	17	23	30	33	35	46	61	67	76	92	120	(a)	(b)	(c)	(d)	(e)	(f)
Euglena fusca	June 20, 1938	--	2	26	16	14	---	14	*40*	6	---	---	---	---	2	---	---	---	---	---
Euglena fusca	July 27, 1938	-		1	-	--	-	-	*18*	2	8	4	--	--	-	- -	---	---	---	---
Euglena pisciformis	Aug. 5, 1937	2	*42*	34	14	40	2	16	---	4	---	---	--	---	---	---	---	---	---	---
Euglena pisciformis	Aug. 30, 1938	4	1	1	4	*110*	---	30	1	2	1	---	---	--	--	1	--	---	---	---
Euglena polymorpha	Aug. 5, 1937	18	64	88	*68*	28	---	---	---	---	---	---	---	---	---	---	---	--	---	---
Euglena polymorpha	Aug. 30, 1938	8	18	21	*205*	-	256	44	12	11	- -	---	---	---	4	34	9	--	---	---
Euglena viridis	Aug. 18, 1937	-	34	*60*	32	44	4	42	--	10	--	---	---	---	--		---	---	---	---
Euglena viridis	Aug. 30, 1938	--	1	1	2	*100*	---	46	6	---	6	---	---	---	1	2	---	---	---	---
Lepocinclis texta	July 22, 1938	2	*10*	5	---	1	---	---	---	2	2	1	--	--	--	-	-	- -	---	---
Lepocinclis texta	July 27, 1938	3	2	3	1	*22*	---	---	16	---	6	---	--	--	--	---	---	---	---	---
Trachelomonas crebea	May 23, 1938	2	28	25	24	16	---	---	*104*	*104*	80	3	80	80	1	1	1	2	---	1
Trachelomonas crebea	Aug. 19, 1938	30	40	*120*	40	40	---	---	90	60	40	---	100	4	10	6	1	---	3	---
Trachelomonas urceolata	June 15, 1938	70	2	20	20	20	-	*120*	50	10	100	---	10	---	2	---	-	---	22	---
Trachelomonas urceolata	June 20, 1938	10	--	20	*60*	20	---	80	4	2	12	---	20	---	12	10	10	---	---	---

NOTE.—Tributary streams near junction with Scioto River:
(a) Big Walnut. (d) Deer Creek.
(b) Little Walnut. (e) Paint Creek.
(c) Darby Creek. (f) Salt Creek.

time in the recovery zone. Such instances demonstrate the necessity for using average distribution figures. It has not been possible thus far to trace one of these maxima downstream. While aggregations of plankton organisms move down to some extent, it has not yet been shown whether the observed maxima move at current speed, whether they lag, or whether they are dispersed as the current carries them into a changed environment. Such information would be useful and work on this point is urgently needed.

EUGLENIDAE IN OTHER SITUATIONS

If the green Euglenidae are not found predominantly in the zones of highest pollution, what is their ecologic status relative to pollution? In June 1938, a biological survey of the Licking River of Kentucky was made at a time when the river was clear and rather low. The main stream, rising in mountainous country, gets the sewage of a very small population, and flows rather swiftly until it meets the South Fork at Falmouth, Ky. The South Fork, which is much shorter, gets the sewage of several good-sized towns, Paris, Cynthiana, and Mount Sterling, but also has a much slower current, and has low head dams in three places. It is nowhere grossly polluted, and at Cynthiana is used as a water supply, although only a short distance below Paris. Examination at seven points on the North Fork, down almost to Falmouth, gave a total of 6 species of green Euglenidae of which only three, *Euglena* species, *Trachelomonas urceolata*, and *T. volvocina*, were sufficiently abundant to count, 2, 4, and 2 per milliliter, respectively. On the South Fork, however, 15 species were found, in numbers from 1 to 180 per milliliter. All of these were forms normally found in the Scioto, the most abundant being *Euglena gracilis*, 180 per milliliter, *Euglena* species, 100 per milliliter, *Trachelomonas crebea*, 90 per milliliter, *T. urceolata*, 160 per milliliter, and *T. volvocina*, 30 per milliliter. These counts were made where there was no visible evidence of sewage pollution. The North Fork water was turbid with silt, and not aged greatly, due to rapid run-off. The South Fork water was relatively clear, but possibly older water, and, in addition, it had been polluted by sewage but not sufficiently to show visual evidence.

These two streams, the Scioto and Licking Rivers, present instances where there are large populations of green Euglenidae in areas below sewer outfalls. The maximum population of such plankton is not in grossly polluted water, however, but below such stretches. The North Fork of the Licking also offers an instance of a moderately large and rapidly flowing stream which contains almost no sewage and has a small population of euglenid flagellates. A parallel case is the Great Miami River and its tributary, the Whitewater River.

The latter is relatively swift and gets little sewage, whereas the Great Miami is slowed up by dams, gets the sewage and industrial wastes of several cities, and at times has many Euglenidae. The Whitewater is less turbid than the North Fork of the Licking, and the Great Miami is comparatively clear but sometimes contains paper-mill wastes.

These instances show that Euglenidae are certainly abundant in some waters containing sewage. It is our contention that clarity of water and age of water are factors favoring their development also, and that the pollution of a river by domestic sewage is not alone sufficient to cause the development of a large population of these green flagellates. Pollution, followed by ageing and clarifying of water, may be more favorable to their development, and a seasonal

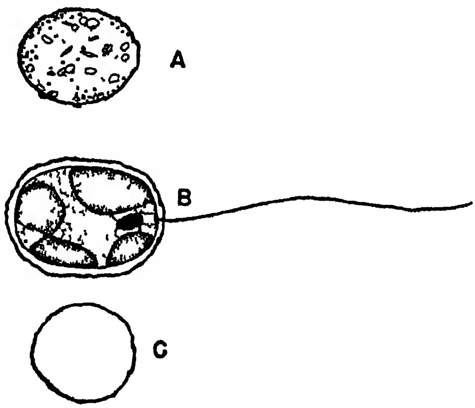

FIGURE 6.—*Trachelomonas crebea*. Smaller (as a rule) forms than those in figure 1, with a thin deep brown shell, fewer chloroplasts, which are large and usually without pyrenoids. *A*, *B*, and *C* represent the greatest variation in shell form for this species and *B* shows the internal structure.

factor may also be added. Pollution certainly seems to be a contributing factor, but to use these organisms as indicators of sewage contamination would require that sewage be more than a contributing factor for their excessive increase. In 1938, 48 samples were taken from the Cumberland and Duck Rivers in Tennessee. The upper watershed of the Cumberland is very rugged and run-off is fast, while the water at the time the samples were taken was decidedly turbid with erosion silt. In 183 miles of the Cumberland above mile 198 (from the mouth) the only Euglenidae found were *Trachelomonas crebea* and *T. urceolata* (figs. 1 and 6) which occurred in 3 samples, and a species of *Euglena* in one sample. Apparently, age of water, silt, and lack of organic contamination militated against the organisms. At mile 218, the Cumberland begins to get material quantities of sewage; between miles 198 and 218 the sewered population numbers 26,000, and industrial wastes are poured into the river from two cheese

plants, a condensed milk plant, a woolen mill, and a large viscose rayon plant. At about mile 190, Nashville, with a population of 150,000, empties its untreated sewage into the river. Sixteen miles below this point the greatest numbers of Euglenidae were found. While they were found in all samples between miles 88 and 198, their total and average numbers were very low as compared with samples from the Scioto at the same time of year and only nine species were identified. One additional group, termed *Euglena* sp., was present in small numbers, but the bulk of the population was made up of *Trachelomonas crebea* and *T. urceolata* whose distribution in the Scioto is quite variable. *Euglena viridis* occurred in small numbers in only three samples, not being found above mile 150. Evidently the addition of the sewage of a large city failed to be more than a very mild stimulus to the development of Euglenidae in the Cumberland River.

In September 1939, the senior author again made a careful survey of the Cumberland, examining fresh samples taken from numerous stations above, at, and below Nashville. The stream was very low, the temperature high, the flow was very sluggish and the stream clear. Despite these supposedly favorable conditions, the numbers of Euglenidae were few and there was no material increase at or below Nashville, although the polluted condition of the river was all too apparent

With regard to the Duck River, the Tennessee health authorities (*6*) state that between miles 150 and 174 from the mouth the river carries a heavy load of sewage pollution. Six known species of Euglenidae, and one unidentified (*gracilis* group(?)) *Euglena* were found in these samples in 1938 as follows:

River miles	98	122	130	136	186	216	225
Numbers of Euglenidae per milliliter	26	80	106	436	38	29	4

Almost all of these were *Trachelomonas urceolata* and *Euglena* sp. The large numbers at mile 136 are not due to sewage; to quote from Dr. Williams (*6*), "This (sewage) pollution is not present at mile 136 since this point is above Columbia (Tenn.), and the nearest known pollution is that from Shelbyville, which is about 80 miles upstream." Actually, despite the sewage of Columbia, entering at mile 130, there is a steady decrease of these green flagellates downstream.

The Duck River was also surveyed in September 1939, and while a heterogenous plankton was present, there was no large population of Euglenidae anywhere in the stream, regardless of the presence or absence of sewage. In short, biological surveys of these two streams have flatly failed to show that sewage encourages the growth of Euglenidae.

DISCUSSION

Sudden enormous increases of microorganisms, often with little or no indication of the cause, are well known to biologists. This is especially true of Euglenidae, and is shown perhaps in the numbers at Red Bridge (fig. 3) in September and August 1937 and 1938. An examination of the data for suspended solids, 5-day B. O. D., pH, 37° agar counts, and coliform counts of bacteria shows no correlative aspect for the rise in August, the sudden drop on September 3, and the subsequent sharp rise and fall in 1937. The decline in early August 1938 was due to a rain, either dilution of the volume of river water or the attendant jump in suspended solids (largely silt) from 160 p. p. m. to 530 p. p. m. There was a prompt recovery, however, to 790 organisms per milliliter of raw river water; then another heavy rain about September 12 decreased numbers to about 25 per milliliter. The increases are very difficult to account for and can hardly be attributed to changes in the river traceable to sewage. No known river factor, light, temperature, chemical composition, and the like, undergoes such violent fluctuations as shown by figure 3, not even volume and turbidity following a rain.

The species listed for the Scioto are fairly well recognized. Only one group of the genus *Euglena*, comprising possibly *Euglena agilis*, *E. gracilis*, and *E. pisciformis*, offers much difficulty. Of these the senior author (*7*) has found only one, *E. gracilis*, abundant in sewage plants. Peterson (*8*) has reported *E. polymorpha* as abundant in this same plant. *Euglena polymorpha* has been noted (*9*) as a bloom on an unpolluted country pond, and we have also noted it as a bloom on water in a cedar swamp at Woods Hole, Mass. We have found *E. sanguinea* as a common late summer bloom on hot, muddy ponds or borrow pits. Eddy (*10*) has reported it as a bloom on sink holes in southern Illinois. *E. mutabilis* has been found as a dominant (*11*) in highly acid coal mine drainage. We have procured *E. deses* in large numbers from stagnant, but not sewage-polluted drainage ditches *E. oxyuris* has been reported by Senior-White (*12*) as high as 100 per milliliter in a "foul tank" used as a buffalo wallow at Delhi, India. *E. viridis* has constituted 98 percent of the population of a small pool fed by a small city sewer during street construction in Cincinnati. Eddy (*13*) reported a number of Euglenidae in the Sangamon River in 1929, but never as many as 1 per milliliter; he considers the river "a fairly clean stream." Kofoid (*14*) found many of these species in the Illinois River between 1894 and 1899, inclusive, when it was a clean stream, not getting the sewage of Chicago through the drainage canal. He recorded 24 species of this group, all but two of which have been found in the Scioto. *Euglena viridis* was most abundant, *E. oxyuris* next. None of the other abundant Scioto River Euglenidae

were found in large numbers by him, but *Trachelomonas volvocina* occurred in the Illinois in abundance. In 1921-22 Purdy (*15*) reexamined the plankton of the Illinois and found only *Euglena viridis* in noteworthy numbers. Allen (*16*) found six species of Euglenidae in net samples from the San Joaquin River, but it is difficult to relate them to pollution. Such a search through the literature fails to show a definite correlation between sewage pollution and species, or even numbers, of Euglenidae present. *Euglena viridis* and *E. oxyuris* have been shown to be present in large numbers in polluted waters, but we question that they do not occur abundantly elsewhere. We believe that the finding of other species in great abundance where there is no evidence for sewage pollution shows that the group as a whole should not be used as indicating sewage pollution. We do believe that the evidence from the Scioto River studies indicates only one species, *E. viridis*, to be valuable as such an indicator, and even it may occur in abundance in a zone where pollution is revealed only by careful chemical and bacteriological studies. Furthermore, of the Euglenidae as a whole, our experimental studies and a survey of the literature indicate that only the following species tend to occur in abundance in sewage-polluted water: *Cryptoglena pigra*, *Euglena fusca*, *E. gracilis*,[1] *E. oxyuris*, *E. pisciformis*, *E. polymorpha*, *E. viridis*, *Lepocinclis texta*, *Phacus pyrum*, *Trachelomonas crebea*, and *T. urceolata*.

Since some of these have been found by us and by other observers in huge numbers in environments not polluted by sewage, or in situations far from sewage pollution where recovery of a sick water was taking place, we believe that it is more accurate to state that the abundance of these organisms *may* mean pollution; it probably means the presence of organic substances, or end products of decomposition of organic compounds. We do not believe they should be regarded as indicators of sewage pollution, unless other evidence is adduced in support.

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[1] Probably includes several morphologically related species.

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THE BACTERIAL ASSAY OF RIBOFLAVIN IN THE URINE AND TISSUES OF NORMAL AND DEPLETED DOGS AND RATS

By H. F. Fraser, N. H. Topping, and H. Isbell, *Passed Assistant Surgeons, National Institute of Health, United States Public Health Service*

Snell and Strong (*1*) have reported a method for the assay of riboflavin using the *Lactobacillus casei.* They observed that their microbiological assays checked very well with rat assays performed on the same materials. In order to determine the efficacy of this test in following the nutritional status of experimental animals, we have applied their technique to the assay of urine and tissues obtained from normal and riboflavin deficient dogs and rats.

The method of Snell and Strong is dependent upon the observation that the amount of growth of a specific strain of *Lactobacillus casei* and the resulting acid production is proportional to the amount of riboflavin in an otherwise riboflavin deficient medium. It may be outlined briefly as follows: With each set of assays a control group of tubes is prepared containing 10 ml. of medium; duplicate tubes contain 0.0, 0.05, 0.075, 0.1, 0.15, 0.2, and single tubes contain 0.3 and 0.5 micrograms of riboflavin, respectively. In a similar manner the unknown material is added in the form of an aqueous extract to duplicate sets of tubes in graded amounts. All tubes are autoclaved, cooled, and inoculated with 0.1 ml. of a saline suspension of a 24-hour culture of *Lactobacillus casei.* After incubation at 37° C. for 72 hours the acid formed in each tube is titrated with 0.1 normal sodium hydroxide. Over the range from 0.05 to 0.25 micrograms of riboflavin the turbidity resulting from bacterial growth and the acid production is

proportional to the amounts of riboflavin in the tubes. A curve, therefore, can be constructed from the titration values of the controls from which the riboflavin content of the unknown tubes can be interpolated. Preliminary experiments using the microbiological assay were performed in this laboratory. It was observed that the method was sensitive to $\pm$ 0.01 to 0.02 gamma of riboflavin and it was possible to repeat assays on the same material within $\pm$10 percent.

EXPERIMENTAL METHODS

A. Selection of animals (dogs). - Adult mongrel dogs were used in these experiments. One female dog (No. 388) and 7 male dogs (Nos. 358, 391, 392, 396, 401, 407, and 429) were standardized for a minimum of 134 days on stock diet 326. These animals were in excellent condition when they began a basal nicotinic acid deficient diet on October 3, 1938. They were observed on this diet under varying doses of nicotinic acid but with a constant supplement of 10.4 gamma of riboflavin per 100 calories of ration until February 27, 1939, when the experiments here reported were started. The urine of all these animals was examined at intervals for riboflavin. Three of these dogs (Nos. 392, 396, and 407) were used to determine the riboflavin content of tissues in depleted animals. They remained on a basal diet with no addition of riboflavin for 121, 101, and 47 days, respectively.

As controls for the riboflavin content of the urine, 1 female dog (No. 430) and 3 male dogs (Nos. 431, 432, and 433) were standardized for a minimum of 132 and a maximum of 252 days on stock diet 326. They were in excellent condition when they began a high liver and high yeast diet 515 on March 8, 1939.

As controls for the riboflavin content of tissues, 1 male dog (No. 443) and 2 female dogs (Nos. 417 and 437) were standardized on diet 326 for 33, 362, and 132 days, respectively, when each was sacrificed.

B. Selection of animals (rats). - Rats were reared on stock diet 507 and then assembled in lots of 4 animals. The influence of riboflavin deficiency was tested in both sexes by means of litter mates of the same sex in control and depleted lots. Lots 1850 and 1851 were 72 days of age and lots 1841, 1842, 1843, and 1844 ranged from 25 to 27 days of age when they were placed on basal diet 513. Lots 1860 and 1861 ranged from 20 to 23 days of age when they were placed on diet 513, a paired feeding technique being used. Control lots 1850, 1841, 1843, and 1860 received a supplement of 50 gamma of riboflavin daily.

C. Diets and supplements served dogs and the riboflavin assay values of these diets.—

1. Stock diet 326 for dogs, as used by Goldberger and his associates, contains graham flour 63,[1] whole milk powder 20, dried pig liver 10, brewer's yeast 3.3, calcium carbonate 1,[1] sodium chloride 1,[1] and cod-liver oil 1.7 parts per 100. The riboflavin assay of this diet diluted with water for serving showed 5.5 gamma per gram. When this value is corrected for the added water, the riboflavin content of the diet is 22 gamma per gram. (All the diets were assayed by the bacterial method of Snell and Strong (*1*) as they were served to the animals.)

[1] These ingredients are stirred into water and cooked in a double boiler of enamelware for about 1½ hours. The other ingredients are well stirred in, the total weight brought to 2,400 grams with water (so that 1 gram represents 1 calorie). This finished mixture is fed to the dog *ad libitum*. Each day the food served to every dog is weighed; the following day the residue is deducted and the net food intake recorded.

2. High liver, high yeast diet 515 for dogs contains graham flour 46,[1] whole milk powder 16, dried pork liver 19.5, brewer's yeast 15, cod-liver oil 1.5, calcium carbonate 1,[1] and sodium chloride 1[1] part per 100. The riboflavin assay of this diet diluted with water for serving showed 10.2 gamma per gram. When this value is corrected for the added water, the riboflavin content of the diet is 40 gamma per gram.

3 Riboflavin deficient diet 507 for dogs contains cornmeal 74,[1] leached casein 16, Osborne and Mendel salt mixture 3.6,[1] cod-liver oil 2.4, and cottonseed oil 5 parts per 100. The riboflavin assay of this diet diluted for serving showed 0 17 gamma per gram. When this value is corrected for the added water, the riboflavin content is 0.65 gamma per gram. (The riboflavin values of the dog and rat diets with a high riboflavin content are probably reasonably correct, but the values given for diets with a low riboflavin content are probably too high, because in the latter case it is necessary to add a large amount of extraneous material to the assay tubes and this interferes with the performance of the test. This is in accord with the observations of Snell and Strong (*1*).) This basal diet is deficient in nicotinic acid as well as riboflavin. Dogs 391, 392, 396, 401, and 407 received sufficient nicotinic acid daily to protect them from any symptoms of blacktongue. Dogs 358, 388, and 429 were deprived of nicotinic acid during most of the period when urine was collected for riboflavin assay. (Dogs 388 and 429 died of blacktongue in April 1939.) From October 3, 1938, to May 31, 1939, each dog received 10.4 gamma of riboflavin per 100 calories of ration. On May 31, 1939, dogs 392 and 407 were given in their food a dose of riboflavin equivalent to 100 times their previous intake. This represented 7.75 mg. for dog 392 and 7 25 mg. for dog 407. (On June 4, 1939, dog 391 died of acute hemorrhagic pancreatitis.) On June 5, 1939, dogs 358 and 401 were given 100 times their daily riboflavin intake by intramuscular injection. This was 11.5 mg. for dog 358 and 7.25 mg. for dog 401. Between May 31, 1939, and June 5, inclusive, dogs 358, 391, 392, 396, 401, and 407 received their daily supplement of 10 4 micrograms of riboflavin except as above mentioned. On June 6, 1939, there were 5 dogs (Nos. 358, 392, 396, 401, and 407) remaining on the experiment and their daily supplement of riboflavin was discontinued.

D. Diets and supplements served rats and the riboflavin assay values of these diets.—

1. Stock diet 516 for rats contains whole ground soft wheat 28, whole ground yellow corn 28, ground green leaf alfalfa 10, dried pork liver 6, whole-milk powder 25, cod-liver oil 1, ground bone meal 1.5, and sodium chloride 0.5 parts per 100. In addition each rat received a moderate amount of lettuce daily. The riboflavin assay of this diet, excluding the lettuce, showed 19 gamma per gram.

2. Riboflavin deficient diet 513 for rats contains corn starch 55, leached and alcohol extracted casein 15, cod-liver oil 2, cottonseed oil 4, Osborne and Mendel salt mixture 4, and ether extracted rice polish 20 parts per 100. The riboflavin assay showed 1.2 gamma per gram of basal diet. Control lots 1841, 1843, 1850, and 1860 on this diet received 50 gamma per day of riboflavin for 5 days a week and 100 gamma per day 1 day a week. This was mixed with the food.

Rats were fed *ad libitum* except for the young rats in lots 1860 and 1861 which were placed on paired feeding technique.

E. Collection and preservation of urine and method of assaying for riboflavin.—The method of urine collection from dogs has been previously reported (*2*). Briefly, the procedure is as follows: After voluntary urination each dog received by stomach tube the maximum amount of water which he would comfortably retain. The urine was collected during a subsequent 4-hour period in dark-colored bottles. Male dogs were catheterized for residual urine. An aliquot of

[1] See footnote 1, p. 281.

the entire specimen was then either passed through a Berkefeld filter No. N [2] immediately or temporarily refrigerated and then filtered. The urine was collected about once weekly from the dogs beginning on February 27, 1939, and continued in the case of dog 392 to August 24, 1939. The urine collection may be divided into three periods in relation to the riboflavin intake of the dogs. There was first a period of 8 months on a very low maintenance supplement of 10.4 gamma per 100 calories of food intake. Specimens of urine were collected during the last 3 months of this period. There was then a brief period of 6 days when 4 dogs were given 100 times their customary supplement of riboflavin. There was finally a period of 2 to 4 months, depending on the length of life of the animal, during which no supplement of riboflavin was given. All of the urines from any given dog or lot of rats were assayed at one time and the urines of control and depleted animals were tested simultaneously insofar as feasible.

The assay technique of Snell and Strong (*1*) was followed except for three modifications.[3] 1. Owing to the small amount of urine preserved for testing, only 5 ml. instead of 10 ml. total volume of solution were used in each assay tube. 2. Samples of urine from depleted animals which contained small amounts of riboflavin were tested at two different levels, and a few samples were tested at one level only. 3. It was found necessary to adjust the pH of the urine to approximately 6.7.

The urine of control dogs was customarily added to 2.5 ml. of basal medium in amounts ranging from 0.05 to 0.25 ml. The urine of depleted dogs was usually added to the basal medium in amounts ranging from 1.0 to 2.5 ml. In amounts from 0.05 to 0.25 ml. the urine of control dogs showed no evidence of inhibiting substances for the *Lactobacillus casei*. In the case of some depleted dog urines, however, the riboflavin assay values obtained with the addition of 2.5 ml. of urine to the basal medium were 10 to 30 percent lower than those observed with the addition of 1 ml. of the same urine to the basal medium. This suggested that the urine of some depleted dogs contained one or more inhibiting substances for the *Lactobacillus casei*. This effect was not observed consistently in the depleted dogs and was not of sufficient magnitude to influence the results materially.

F. Method of assaying tissues.—The animal was sacrificed and exsanguinated immediately. The tissues were removed at once and a small portion weighed in an Erlenmeyer flask. Water was added and the mixture autoclaved according to the method of Snell and Strong (*1*). After autoclaving, the tissue was macerated with a glass rod, the mixture was centrifugalized, the supernatant liquid was decanted and adjusted to a pH of approximately 6.7. Aliquots of the extract so prepared were used for the microbiological assay. It was noted that blood contained one or more factors which inhibit significantly the growth of the *Lactobacillus casei*. The extent of this inhibition was of sufficient magnitude to make the results on blood assays of little or no value. Extracts of all other tissues tested showed no evidence of any appreciable inhibiting effect for the growth of this organism.

G. Clinical course of animals.—It has been previously reported from this laboratory (*9*) that adult dogs seldom show symptoms of riboflavin deficiency until death is imminent. The dogs in this experiment were continued on a low maintenance diet of riboflavin (10.4 gamma per 100 calories of food) from October 3, 1938, to June 6, 1939. During this period one dog, No. 407, developed a purulent conjunctivitis of the left eye. This symptom was first noted on May 20, 1939,

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[2] It has been observed that Berkefeld filters will absorb variable amounts of riboflavin from urine. In the case of urines containing as little as 0.02 gamma per ml. this may be as much as 50 percent.

[3] The original culture of *Lactobacillus casei* used in these experiments was supplied through the courtesy of Dr. E. E. Snell.

or 7½ months after beginning this regime. He was given 7.25 mg. of riboflavin in 1/50 normal acetic acid on May 31, 1939. On June 6 the inflammation and purulent discharge from the left eye was greatly improved and the daily supplement of riboflavin was discontinued. On June 22 there was definite evidence of cataract formation with beginning opacity of the left cornea and lens. On June 30, 1939, the right eye showed beginning purulent inflammation; there was redness of the tongue and the floor of the mouth and superficially ulcerated lesions on the scrotum. This animal was sacrificed in coma on July 23, 1939. The autopsy examination showed a cataract of the left eye, purulent conjunctivitis of the right eye, scrotal dermatitis, atrophy of the testicles and a "yellow liver." Dog 392 developed scrotal dermatitis and a bilateral cataract and was sacrificed on October 15, 1939, upon the onset of coma. Autopsy examination showed a "yellow liver." Dog 396 displayed no symptoms of riboflavin deficiency at any time and was sacrificed on September 18, 1939. No other animals remained on the riboflavin deficient regime sufficiently long to manifest symptoms of this deficiency.

The control rats on diet 513 plus 50 gamma of riboflavin per day were normal. The young males in lots 1841 and 1843 which received this supplement showed an average gain of 31 grams per week during the first 8 weeks. The young adults in lot 1850 showed an average gain of 22 grams per week during the first 8 weeks.

The depleted young rats in lots 1842 and 1844 attained weight equilibrium in 7 to 8 weeks and then gradually lost weight. The depleted adult rats in lot 1851 continued to gain for a period of about 14 weeks. During the succeeding 3 weeks there was little variation in weight and the experiment was terminated. In order to avoid complications from other diseases in the depleted animals all of the rats were in relatively good condition when they were sacrificed for tissue assay. They showed, however, such symptoms as depilation about the eyes, face, and scrotum, encrustations of the vibrissae, and loss of muscle tone.

RESULTS

Urine.—The urine of some depleted dogs showed the presence of one or more inhibiting substances for the growth of the *Lactobacillus casei.* This effect was not of sufficient magnitude, however, to influence the results materially. The urine of both control and depleted dogs was passed through a Berkefeld filter. These filters absorb variable amounts of riboflavin. For these reasons, the urine assay values herein reported cannot be taken to represent the absolute amounts of riboflavin present in the urine. Since, however, all the urines received the same treatment, they are satisfactory for a comparison of the relative excretion of riboflavin in the urine of control and depleted animals.

The riboflavin assay values obtained on dog urine are presented in table 1.

Under the conditions of this experiment, the riboflavin assay values observed on the urine of control dogs was about 20 times that found in depleted dogs.

On May 31, 1939, dog 392 was given 7.75 mg. and dog 407 was given 7.25 mg. of riboflavin by stomach tube. The urine from each of these dogs was collected for a 4-hour period 24 hours later and showed a

TABLE 1.—*Riboflavin assay values of dog urine* [1]

Control dogs (high yeast and liver diet 515)				Depleted dogs (basal diet 507)[2]			
Dog No.	Number of assays	Gamma per ml.	Gamma q.4 hrs. per kg.	Dog No.	Number of assays	Gamma per ml.	Gamma q.4 hrs. per kg.
430	4	[3] 0.65±0.117	[3] 39 2±2.84	396	8	[3] 0 019±0.001	[3] 1.0 ±0 22
431	4	.36± .002	19.3±4.95	388	2	.01± .0	.45± .16
432	6	.25± .06	11.5±1.86	392	10	.018± .0024	1.06± .12
433	7	.35± .042	19.4±1.61	301	8	.013± .0002	.58± .055
				401	10	.020± .005	1.28± .36
				407	14	.018± .00025	1.00± .075
				358	10	.021± .00045	1.28± .11
				429	6	.025± .00045	2.35± .55
Mean of group		.40	22.4			.018	1.13
S. E. M. of group [4]		± .08	±5.9			± .002	± .2

[1] As explained in the text, the riboflavin values given in this table are suitable for a comparison of control and depleted dog urine, but should not be interpreted as representing absolute amounts of riboflavin contained in the urine.
[2] The riboflavin values for depleted dogs given in the table comprise 68 assays. Fifty-five of these were performed when the dogs were receiving 10.4 gamma of riboflavin per 100 calories of food, the remaining 13 during a period when no supplement of riboflavin was given. The riboflavin content of the urine showed no decreases after the maintenance supplement was discontinued.
[3] Mean for each animal±the standard error of the mean.
[4] S. E. M.=standard errors of the mean (*4*).

riboflavin assay value as low as that obtained during the administration of 10.4 gamma per 100 calories of food. On June 5, dog 401 was given 7.25 mg. of riboflavin by intramuscular injection. The urine collected for a 4-hour period 24 hours later showed a riboflavin assay value below the average of this dog while on a low maintenance dose. But in the case of dog 358, which received 11.5 mg. of riboflavin by intramuscular injection on June 5, 1939, urine collected during the succeeding 4 hours showed an assay value of 4.95 gamma per ml. or 2.525 mg. excreted for a 4-hour period. The amount of this injection was 100 times the former daily intake and the excretion during the succeeding 4 hours as determined by this assay was 206 times the mean output during a low maintenance period.

The depleted dogs excreted riboflavin in small amounts over a relatively limited range. There were no assays on the urines of the dogs from October 3, 1938, when the low riboflavin diets were begun, until February 27, 1939. The assays were started on the latter date and continued through August 24, 1939. The quantity of riboflavin in the urines remained fairly constant after February 27, 1939, irrespective of whether the animals were continued on low maintenance intakes or were completely deprived of riboflavin supplements. The supplements were discontinued on June 6, 1939.

The rat urine assay values do not permit a quantitative interpretation of results respecting absolute quantities of riboflavin for reasons mentioned in the case of dog urine. It only permits a comparison of the control and depleted animals.

The riboflavin assay values obtained on rat urine are presented in table 2.

TABLE 2.—*Riboflavin assay values of rat urine* [1]

Control rats (basal diet 513 plus 50 gamma/day riboflavin)			Depleted rats (basal diet 513)		
Rat lot [2] number	Number of assays	Gamma q.5 hours per lot	Rat lot [2] number	Number of assays	Gamma q. 5 hours per lot
1841 [3]	3	1.7	1842 [3]	3	0.29
1843 [4]	3	.77	1844 [4]	3	.37
1850 [5]	5	1.57	1851 [5]	5	.58
Average		1.36			.41

[1] As explained in the text, the riboflavin values given in this table are suitable for a comparison of control and depleted rat urine, but should not be interpreted as representing absolute amounts of riboflavin contained in the urine.
[2] There are 4 rats in each lot. The animals in lot 1841, for example, are litter mates of the same sex as rats in lot 1842, etc.
[3] In the case of lots 1841 and 1842, the first sample was obtained 6 weeks and the last sample 10 weeks after the diet was started.
[4] In the case of lots 1843 and 1844, the first sample was obtained 7 weeks and the last sample 10 weeks after the diet was started.
[5] In the case of lots 1850 and 1851, the first sample was obtained 3 weeks and the last sample 15 weeks after the diet was started.

Under the conditions of this experiment, the riboflavin assay values observed on control rats was about 3 times that found in the urine of depleted rats.

Tissues.—Although marked differences were observed respecting the riboflavin content of corresponding tissues in control and depleted dogs, the variations within each group were so great that none of the differences were statistically significant.

The differences between the means (*4*) of the riboflavin content of the liver and muscle of control and riboflavin deficient adult rats are highly significant ($p<0.01$) as are the differences between the means of the riboflavin content of the liver, kidney, and muscle of the rats on stock diet 516 and depleted rats.

TABLE 3.—*Riboflavin content of dog tissues expressed as gamma/gram of fresh tissue. (The values given represent the mean for all the animals of a group ± the standard error of the mean (4))*

Tissue	Control dogs (stock diet 326)		Depleted dogs [1] (basal diet 507)	
	Number of animals	Gamma/gram	Number of animals	Gamma/gram
Liver	3	30 ± 7.4	3	12 ±2.3
Kidney	3	44 ±22	3	20 ±2.3
Muscle	3	6.6 ± 1.66	2	3.1 ± .1
Suprarenal	3	10.4 ± 2.69	2	5.2 ± .1
Heart	3	14 ± 3.9	2	10 ±.71
Brain	3	3.4 ± 1.11	2	2.6 ± .3
Skin	3	1.11± .32	2	.9 ±.38
Blood	3	.63± .11	2	.38±.13

[1] Each of the depleted dogs was on a daily dose of 10.4 gamma/100 calories of food for 245 days. One of them then received one dose of 7.25 mg. of riboflavin by mouth. From this time until they were either sacrificed or developed terminal symptoms of riboflavin deficiency none of them received a supplement of riboflavin; this constituted an average of 91 days.

TABLE 4.—*Riboflavin content of adult rat tissues expressed as gamma/gram of fresh tissue. (The values given represent the mean for all the animals of a group ± the standard error of the mean (4))*

Tissue	8 controls (stock diet 510, gamma/gram)	4 controls [1] (basal diet 513, gamma/gram)	4 depleted [1] (basal diet 513, gamma/gram)
Liver	37 ±0.71	33 ±3.55	15 ±1.69
Kidney	32 ± .58	23 ±3.71	20 ±1.79
Muscle	3.2± .20	3.5 ± .57	1.4 ± .17
Heart		17 ±2.63	13 ± .87
Brain		3.3 ± .43	2.8 ± .35
Skin		.92± .31	.90± .32
Blood		.22± .043	.20± .03

[1] Controls and depleted rats on basal diet 513 were sacrificed after they had been on the experiment for an average of 130 days.

The differences between means of the tissues of control and depleted young rats which have been on a paired feeding regime are highly significant ($p<0.01$) for all tissues except brain and blood.

TABLE 5.—*Riboflavin content of young rat tissues expressed as gamma/gram of fresh tissues (paired feeding)*

Tissue	Lot 1860 (4 controls,[1] basal diet 513 gamma/gram)	Lot 1861 (4 depleted,[1] basal diet 513 gamma/gram)
Liver	41 ±1.85	15 ±0.76
Kidney	27.5 ± .20	22 ±1.32
Muscle	3.5 ± .1	1.6 ± .14
Heart	17.5 ±1.69	11 ± .96
Brain	3.6 ± .03	2.8 ± .3
Skin	1.89± .09	1.39± .006
Blood	.25± .028	.21± .015

[1] Controls and depleted rats were sacrificed after they had been on the experiment for an average of 63 days.

DISCUSSION

A marked reduction in the riboflavin content of the urine of deficient dogs and rats occurs before the animals manifest significant symptoms of riboflavin deficiency. Even though the deficient diet is continued for a long period a small amount of riboflavin persists in the urine. The excretion level of depleted dogs fluctuates in a limited range and tends to be constant for each animal. Vivanco (*5*) using a fluorimetric method, found a marked reduction in the flavin excretion of deficient rats. This investigator could not detect any flavin in the rat urine after 14 days on the deficient diet. However, the method employed by Vivanco is not sufficiently sensitive to detect less than 0.1 gamma of riboflavin (*6*). Emmerie (*7*) placed a healthy human subject on a diet which was calculated to contain 100 gamma per day of riboflavin. During 13 days on this flavin-restricted diet the urinary excretion of flavin varied from 60 to 43 percent of that while on a normal diet. The observations of the investigators cited, together with ours, indicate that the nutritional status of animals respecting

riboflavin can be followed by the determination of this substance in the urine.

The reduced riboflavin content of many tissues in depleted rats, as determined by this bacterial assay, is consistent with the reduced amount of riboflavin in the diet of these animals. Our observations on the riboflavin content of muscle and liver in normal and depleted animals are in agreement with György et al. (*8*) and Carlsson and Sherman (*9*). They are not in accord, however, with the observation of Randoin, Raffy, and Gourévitch (*10*) that the riboflavin content of the liver, heart, lung, and kidney of young rats on a stock diet was no greater than that of similar rats on a riboflavin deficient diet. Each of these groups of workers employed the rat assay method. Kuhn et al. (*11*) and Schormüller (*12, 13*) used physico-chemical methods and the values they reported are considerably lower than those herein presented. Mickelsen, Waisman, and Elvehjem (*14*) have recently reported the riboflavin content of several normal animal tissues in different species using the method of Snell and Strong, and the magnitude as well as the relative amounts of riboflavin in various tissues are in agreement with the findings herein reported.

SUMMARY

1. A microbiological method using the *Lactobacillus casei* was employed for the assay of riboflavin in the urine and tissues of normal and depleted dogs and rats.

2. There is a definite reduction of riboflavin in the urine of depleted dogs and rats as compared to control animals on stock diets, or basal diets adequately supplemented with riboflavin. This depletion of riboflavin content of the urine is observed before the animals manifest significant symptoms of riboflavin deficiency.

3. The riboflavin content of several tissues of depleted dogs and rats was reduced as compared to control animals on stock diets, or basal diets appropriately supplemented with riboflavin.

4. These observations indicate that the bacterial method of Snell and Strong for the assay of riboflavin is a useful adjunct in determining the nutritional status of dogs and rats respecting riboflavin.

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(10) Randoin, L., Raffy, A., and Gourévitch, A.: La teneur en riboflavine (vitamine B_2) dans quelques organes de jeunes rats normaux et soumis à un régime dépourvu de vitamine B_2. Compt. rend. Soc. de Biol., 130: 729 (1939).
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(13) Shormüller, Joseph: Über das Vorkommen von Vitamin B_2 (Lactoflavin). II. Mitteilung. Vitamin B_2 in Organen. Z. f. Untersuch. der Lebensmittel, 77: 316 (1939).
(14) Mickelsen, Olaf, Waisman, Harry A., and Elvehjem, C. A.: The distribution of riboflavin in meat and meat products. J. Nutrition, 18: 517 (1939).

PUBLIC HEALTH SERVICE PUBLICATIONS

A List of Publications Issued During the Period July–December 1939

There is printed herewith a list of publications of the United States Public Health Service issued during the period July–December 1939.

The purpose of the publication of this list is to provide a complete and continuing record of Public Health Service publications, for reference use by librarians, scientific workers, and others interested in particular fields of public health work, and not to offer the publications for indiscriminate free public distribution.

These current lists of publications will be issued in limited numbers for selected distribution to scientific personnel and librarians who have a special need for them and who may find it desirable to bring together in one file a complete list of Service publications.

Those publications marked with an asterisk (*) can be obtained only by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices noted.

Periodicals

*Public Health Reports (weekly), July–December, vol. 54, Nos. 27 to 52, pages 1195 to 2333. 5 cents a number.

*Venereal Disease Information (monthly), July–December, vol. 20, Nos. 7 to 12, pages 185 to 396. 5 cents a number.

Reprints From the Public Health Reports

2086. The induction of carditis by the combined effects of hyperthyroidism and infection. By Mark P. Schultz. July 7, 1939. 24 pages; 10 plates.

2087. The incidence of cancer in Atlanta, Ga., and surrounding counties. By Joseph W. Mountin, Harold F. Dorn, and Bert R. Boone. July 14, 1939. 20 pages.

2088. Allergic irritability in rheumatic and nephritic patients. By Mark P. Schultz. July 14, 1939. 6 pages.

*2089. The diagnosis of oxyuriasis. Comparative efficiency of the NIH swab examination and stool examination by brine and zinc sulfate floatation for *Enterobius vermicularis* infection. By Willi Sawitz, Vada L. Odom, and David R. Lincicome. June 30, 1939. 12 pages. 5 cents.

2090. Studies on the standardization of gas gangrene antitoxin (*Sordellii*). By Sarah E. Stewart and Ida A. Bengtson. August 4, 1939. 6 pages.

2091. Report on market-milk supplies of certain urban communities, July 1, 1937–June 30, 1939. August 11, 1939. 5 pages.

2092. Public Health Service publications. A list of publications issued during the period January–June 1939. August 11, 1939. 6 pages.

2093. Disabling morbidity among employees in the soap industry, 1930–34, inclusive. By Hugh P. Brinton and Harry E. Seifert. July 21, 1939. 16 pages.

*2094. Treatment of induced malaria in Negro paretics with mapharsen and tryparsamide. By Martin D. Young and Sol B. McLendon. August 18, 1939. 4 pages. 5 cents.

2095. Dermatitis caused by a new insecticide. By Louis Schwartz and Leon H. Warren. August 4, 1939. 10 pages.

2096. Dental programs sponsored by health agencies in 94 selected counties. By Joseph W. Mountin and Evelyn Flook. September 8, 1939. 12 pages.

2097. The solubility of lead arsenate in body fluids. By Lawrence T. Fairhall. September 8, 1939. 8 pages.

2098. The National Health Survey. Scope and method of the Nation-wide canvass of sickness in relation to its social and economic setting. By George St. J. Perrott, Clark Tibbitts, and Rollo H. Britten. September 15, 1939. 25 pages.

2099. A procedure for putting health department reports to work. By Mayhew Derryberry and J. O. Dean. September 22, 1939. 10 pages.

*2100. The experimental transmission of poliomyelitis to the Eastern cotton rat *Sigmodon hispidus hispidus*. By Charles Armstrong. September 22, 1939. 4 pages. 5 cents.

2101. The treatment of lymphopathia venereum with sodium sulfanilyl sulfanilate and sodium sulfanilate. By Arthur Hebb, S. G. Sullivan, and Lloyd D. Felton. September 29, 1939. 20 pages.

2102. The protection of mice against *Hemophilus influenzae* (non-type-specific) with sulfapyridine. By Margaret Pittman. September 29, 1939. 6 pages.

2103. Possible relation of calcium deficiency to the utilization of vitamin B_1. Preliminary report. By L. F. Badger and E. Masunaga. September 29, 1939. 4 pages.

*2104. Stabilized method of forecasting population. By Bernard D. Karpinos. October 6, 1939. 15 pages. 5 cents.

*2105. Studies of a filter-passing infectious agent isolated from ticks. V. Further attempts to cultivate in cell-free media. Suggested classification. By Herald R. Cox. October 6, 1939. 6 pages. 5 cents.

*2106. Cultivation of Phase I, *H. pertussis*, in a semisynthetic liquid medium. By J. W. Hornibrook. October 13, 1939. 4 pages. 5 cents.

*2107. The influence of transplanted normal tissue on breast-cancer ratios in mice. By John J. Bittner. October 6, 1939. 5 pages. 5 cents.

2108. Studies in chemotherapy. X. Colorimetric tests for aromatic hydroxylamines and for further oxidation products of aromatic amines. Their demonstration in the urine following sulfanilamide administration. By Sanford M. Rosenthal and Hugo Bauer. October 20, 1939. 11 pages.

*2109. Recovery of the virus of poliomyelitis from the stools of healthy contacts in an institutional outbreak. By S. D. Kramer, A. G. Gilliam, and J. G. Molner. October 27, 1939. 9 pages. 5 cents.

2110. Directory of State and insular health authorities, July 1, 1939. October 27, 1939. 14 pages.

2111. Disabling morbidity, and mortality among white and Negro male employees in the slaughter and meat packing industry, 1930-34, inclusive. By Hugh P. Brinton. November 3, 1939. 13 pages.

*2112. Studies on oxyuriasis. XIV. Controlled tests with various methods of therapy. By Willard H. Wright, Frederick J. Brady, and John Bozicevich. November 10, 1939. 12 pages. 5 cents.

2113. The significance of the excretion of lead in the urine. By Lawrence T. Fairhall and R. R. Sayers. November 10, 1939. 4 pages.

2114. Riboflavin deficiency in man (ariboflavinosis). By W. H. Sebrell and R. E. Butler. December 1, 1939. 11 pages.

2115. Comparison of occupational class and physicians' estimate of economic status. By Jennie C. Goddard. December 8, 1939. 7 pages.

2116. Effect of fluorides on salivary amylase. By F. J. McClure. December 8, 1939. 6 pages.

2117. The cultivation of *Rickettsia diaporica* in tissue culture and in the tissues of developing chick embryos. By Herald R. Cox and E. John Bell. December 8, 1939. 8 pages.

2118. Relapsing fever: *Ornithodoros hermsi* a vector in Colorado. By Gordon E. Davis. December 8, 1939. 3 pages.

2119. Disabling morbidity among employees in the slaughter and meat packing industry, 1930-34, inclusive. By Hugh P. Brinton, Harry E. Seifert, and Elizabeth S. Frasier. December 15, 1939. 24 pages.

2120. *Rickettsia diaporica:* Recovery of three strains from *Dermacentor andersoni* collected in southeastern Wyoming: Their identity with Montana strain 1. By Gordon E. Davis. December 15, 1939. 9 pages.

2121. The relation between the trypanocidal and spirocheticidal activities of neoarsphenamine. V. The spirocheticidal activity of the several American brands of neoarsphenamine. By T. F. Probey. December 22, 1939. 6 pages.

2122. Hemorrhagic adrenal necrosis in rats on deficient diets. By Floyd S. Daft and W. H. Sebrell. December 22, 1939. 4 pages.

2123. Hemorrhagic cortical necrosis of adrenals in rats on deficient diets. By A. A. Nelson. December 22, 1939. 7 pages; 2 plates.

2124. Chloropicrin as a prewarning gas in ship fumigation. By G. C. Sherrard. December 29, 1939. 6 pages; 2 plates.

2125. Successful transfer of the Lansing strain of poliomyelitis virus from the cotton rat to the white mouse. By Charles Armstrong. December 29, 1939. 4 pages.

Supplements to the Public Health Reports

*151. The ratproofing of new ships. By P. W. Clark. 1939. 50 pages; 32 plates. 15 cents.
154. Business census of hospitals, 1935. General report. By Elliott H. Pennell, Joseph W. Mountin, and Kay Pearson. 1939. 38 pages.
155. The Kolb classification of drug addicts. By M. J. Pescor. 1939. 10 pages.
156. Diphtheria. Its prevention and control. 1939. 21 pages.
157. Laws pertaining to the admission of patients to mental hospitals throughout the United States. By Grover A. Kempf. 1939. 29 pages.

Public Health Bulletins

248. Cancer mortality in the United States. I. Trend of recorded cancer mortality in the death registration States of 1900 from 1900 to 1935. By Mary Gover. 1939. 58 pages.
251. Dental health organizations in State departments of health of the United States. By F. C. Cady. 1939. 86 pages.

National Institute of Health Bulletin

172. Fluorides in food and drinking water. A comparison of effects of water-ingested versus food-ingested sodium fluoride. By F. J. McClure. 1939. 53 pages; 27 half-tones.

Miscellaneous Publication

80. The communicable diseases. By A. M. Stimson. 1939. 111 pages.

Unnumbered Publications

Index to Public Health Reports, vol. 54, pt. 1, January–June 1939. 27 pages.
What to know, what to do about cancer. Folder.

Reprints from Venereal Disease Information

111. Sulfanilamide in gonococcal infection: The results of treatment and the leukocyte response. By W. H. Y. Smith, Clarence K. Weil, and B. Cosby Bird. Vol. 20, May 1939. 5 pages.
112. The advantages of the vacuum tube for the collection of serologic specimens. By O. C. Wenger. Vol. 20, May 1939. 3 pages.
113. Postgraduate course in syphilis control. By R. H. Kampmeier and E. Gurney Clark. Vol. 20, June 1939. 4 pages.
114. Electrosurgical treatment of gonorrheal endocervicitis. By Samuel Goldblatt. Vol. 20, June 1939. 7 pages.
115. Venereal disease contact-tracing in Camden, New Jersey. By A. J. Casselman and Anabel Cadwallader. Vol. 20, July 1939. 10 pages.
116. The outlook for syphilis control. By Louise Pearce. Vol. 20, August 1939. 8 pages.
117. The quantitative Kahn reaction. By Reuben L. Kahn. Vol. 20, September 1939. 3 pages.
118. Tryparsamide in the treatment of syphilis. By Josephine Hinrichsen. Vol. 20, October 1939. 30 pages.

119. Spirochete counts in early syphilis. By George Vryonis and Hugh J. Morgan. Vol. 20, November 1939. 5 pages.

Venereal Disease Folders

4. Syphilis on the job.
5. Gonorrhea, the crippler.

Supplements to Venereal Disease Information

10. Control of the venereal diseases in the United States. Present and future plans. 25 pages.

DEATHS DURING WEEK ENDED JANUARY 27, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Jan. 27, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9, 615	9, 115
Average for 3 prior years	9, 733	
Total deaths, first 4 weeks of year	37, 979	36, 362
Deaths under 1 year of age	497	523
Average for 3 prior years	563	
Deaths under 1 year of age, first 4 weeks of year	2, 189	2, 135
Data from industrial insurance companies:		
Policies in force	66, 405, 318	68, 2[illegible]8, 090
Number of death claims	14, 326	14, 854
Death claims per 1,000 policies in force, annual rate	11.3	11.3
Death claims per 1,000 policies, first 4 weeks of year, annual rate	10.3	10.1

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 10, 1940

Summary

A slight decline was shown in influenza for the week ended February 10, with a total of 16,583 cases reported, as compared with 17,641 for the preceding week. The number of cases reported in the corresponding median week of the 5-year period 1935–39 was 4,577, while the 5-year average was 9,732. The 5-year average is influenced by the moderate epidemic of 1937, when 37,101 cases were reported for the peak week of January 30.

The highest incidence persists in the Southern States, with 12,793 cases, or 77 percent of the total, being reported from the South Atlantic and West South Central groups. The East South Central States showed a considerable decline for the current week, as did the North Central and Pacific States.

While it is too early to make any prediction regarding the course of the disease in the next few weeks, it is of interest to note that, in the moderate epidemic years of 1929, 1933, and 1937, the peak was reached in January.

With reference to the virulence of the disease during the current season, as indicated by excess mortality in large cities, the week of February 3 was the first week of 1940 in which the number of deaths in 88 large cities reporting to the Bureau of the Census was above the 3-year average (1937–39). The number of pneumonia deaths in 90 cities distributed throughout the United States, as reported to the Public Health Service, has remained below the 5-year average for each week in 1940 up to and including the week ended February 3.

Favorable conditions continue with reference to the other 8 communicable diseases reported weekly by telegraph to the Public Health Service, all of which, except poliomyelitis, were below the 5-year median. Only 21 cases of poliomyelitis were reported as compared with 18 for the median expectancy.

Telegraphic morbidity reports from State health officers for the week ended February 10, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median, 1935-39	Week ended—		Median, 1935-39	Week ended—		Median, 1935-39	Week ended—		Median, 1935-39
	Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939	
NEW ENG.												
Maine	1	6	2	1	1	3	209	16	155	0	0	0
New Hampshire	0	0	0	2	-----	-----	52	3	18	0	1	0
Vermont	0	0	0	-----	-----	-----	3	27	27	0	0	0
Massachusetts	3	2	3	-----	-----	-----	272	822	612	0	2	2
Rhode Island	1	1	1	-----	-----	-----	111	13	26	0	0	0
Connecticut	0	2	2	2	20	9	177	609	340	0	0	0
MID. ATL.												
New York	22	37	31	[1] 36	183	50	267	1,246	1,246	0	3	4
New Jersey	8	9	11	20	61	30	66	27	219	0	0	1
Pennsylvania	24	33	45	-----	-----	-----	80	170	283	7	7	7
E. NO. CEN.												
Ohio	15	15	27	22	-----	20	22	24	181	1	3	3
Indiana	18	30	30	90	21	52	6	14	32	0	0	4
Illinois	30	32	36	134	227	72	30	36	37	0	0	12
Michigan [2]	9	12	12	11	1	3	251	323	323	0	0	1
Wisconsin	4	1	1	77	65	65	182	708	708	0	1	1
W. NO. CEN.												
Minnesota	3	7	4	1	1	4	359	1,307	120	0	0	1
Iowa	3	8	8	25	8	8	97	154	55	1	0	1
Missouri	10	10	22	33	42	184	5	10	17	0	0	1
North Dakota	3	2	2	61	15	15	13	296	15	0	0	0
South Dakota	1	5	2	4	10	-----	7	319	4	0	0	0
Nebraska	0	3	4	2	-----	5	31	22	22	0	1	1
Kansas	10	17	11	101	3	61	301	20	20	1	0	2
SO. ATL.												
Delaware	0	1	1	-----	-----	-----	1	0	24	0	0	0
Maryland [3]	7	9	9	263	103	103	4	1,050	112	2	0	4
Dist. of Col	0	5	10	10	5	5	2	21	11	1	0	1
Virginia	12	26	24	2,662	553	-----	42	90	163	2	1	10
West Virginia	11	8	17	460	26	151	15	23	23	4	1	3
North Carolina [3]	25	20	23	121	18	67	107	859	778	1	2	3
South Carolina [3]	3	18	3	1,331	701	1,009	6	23	23	2	4	1
Georgia [3]	2	11	11	728	118	490	76	128	0	0	1	1
Florida [3]	4	10	9	50	1	4	41	94	36	0	0	0
E. SO. CEN.												
Kentucky	10	6	9	86	51	101	35	108	108	0	3	6
Tennessee [3]	9	13	16	424	75	176	54	64	64	2	4	5
Alabama [3]	5	5	12	536	186	334	73	284	256	2	1	1
Mississippi [2]	4	6	8	-----	-----	-----	-----	-----	-----	2	3	1
W. SO. CEN.												
Arkansas	8	8	8	1,698	87	166	4	112	13	0	1	3
Louisiana [3]	11	18	13	360	20	44	15	177	71	0	3	0
Oklahoma	8	4	9	604	207	284	4	105	59	1	1	2
Texas [3]	51	20	51	4,437	621	901	270	130	130	3	1	5
MOUNTAIN												
Montana	1	1	2	7	42	42	28	440	20	0	0	1
Idaho	1	3	0	6	-----	5	163	106	74	1	0	0
Wyoming	2	1	1	4	-----	-----	4	92	13	0	0	0
Colorado	9	12	3	26	93	-----	32	61	61	0	1	0
New Mexico	1	3	5	7	9	9	9	51	29	0	0	0
Arizona	2	6	4	297	114	175	13	7	10	0	0	1
Utah [3]	0	0	0	125	24	-----	190	131	24	1	1	0
PACIFIC												
Washington	3	2	2	35	1	4	676	208	107	0	1	2
Oregon	2	1	1	107	40	76	247	34	34	0	0	1
California	22	24	27	1,499	43	461	433	2,261	282	1	1	6
Total	378	491	583	16,583	3,802	4,577	5,085	12,954	12,954	35	48	104
6 weeks	2,628	3,518	4,055	82,180	20,877	20,877	25,982	61,192	61,192	198	323	552

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 10, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939		Feb. 10, 1940	Feb. 11, 1939	
NEW ENG.												
Maine	0	0	0	19	28	25	0	0	0	0	2	1
New Hampshire	0	0	0	4	13	10	0	0	0	0	0	0
Vermont	0	0	0	9	8	16	0	0	0	0	0	0
Massachusetts	1	0	0	134	255	250	0	0	0	2	1	1
Rhode Island	0	0	0	12	5	30	0	0	0	0	1	1
Connecticut	0	0	0	90	122	97	0	0	0	3	0	0
MID. ATL.												
New York	2	2	1	665	647	699	0	0	0	6	2	5
New Jersey	0	0	0	333	172	164	0	0	0	2	0	1
Pennsylvania	0	1	1	370	487	487	0	0	0	8	8	8
E. NO. CEN.												
Ohio	1	1	0	277	517	472	0	17	3	0	0	3
Indiana	0	1	0	221	304	269	6	115	2	1	5	1
Illinois	0	0	0	583	518	750	2	3	11	1	4	3
Michigan [2]	1	0	1	261	504	497	2	25	3	0	4	4
Wisconsin	1	0	0	160	208	361	5	12	11	0	2	2
W. NO. CEN.												
Minnesota	0	1	0	112	154	150	5	4	8	0	0	0
Iowa	4	0	0	70	161	182	9	79	33	0	1	1
Missouri	0	0	0	91	100	145	2	13	17	1	1	2
North Dakota	0	0	0	28	9	9	0	1	2	0	1	1
South Dakota	0	0	0	39	21	23	4	1	6	0	0	0
Nebraska	0	0	0	20	30	53	0	2	5	0	0	0
Kansas	0	0	0	75	179	209	1	5	10	0	1	0
SO. ATL.												
Delaware	0	0	0	10	0	7	0	0	0	0	0	0
Maryland [2]	0	0	0	62	53	73	0	0	0	2	1	1
Dist. of Col.	0	0	0	21	18	18	0	0	0	1	0	0
Virginia	0	0	0	28	54	54	0	0	0	1	4	4
West Virginia	0	0	0	77	53	50	0	2	0	0	2	2
North Carolina [3]	0	0	0	53	83	50	0	0	0	3	1	2
South Carolina [3]	0	0	0	3	11	6	0	0	0	3	3	3
Georgia [3]	2	0	0	25	22	14	2	0	0	2	3	3
Florida [3]	0	1	0	11	12	10	0	0	0	4	2	2
E. SO. CEN.												
Kentucky	0	1	1	94	77	61	0	1	0	3	7	4
Tennessee [3]	0	1	1	61	44	37	1	4	1	0	3	3
Alabama [3]	2	2	1	13	24	22	0	0	1	3	4	1
Mississippi [3]	2	1	1	3	6	8	0	1	0	1	0	1
W. SO. CEN.												
Arkansas	0	1	0	8	12	15	[4] 3	0	1	2	8	1
Louisiana [3]	0	1	0	13	7	14	0	0	0	2	12	12
Oklahoma	1	0	0	31	71	32	1	21	2	1	7	3
Texas [3]	1	0	1	75	89	89	1	39	25	8	10	10
MOUNTAIN												
Montana	0	0	0	53	21	34	0	0	11	0	1	1
Idaho	1	0	0	42	20	17	1	1	2	1	0	0
Wyoming	0	0	0	4	6	18	0	0	5	0	1	0
Colorado	0	0	0	59	37	80	13	13	5	0	0	1
New Mexico	0	1	0	13	20	25	0	0	0	3	3	3
Arizona	0	0	0	13	4	22	1	8	0	0	0	0
Utah [2]	0	0	0	31	15	66	0	0	0	0	0	0
PACIFIC												
Washington	0	0	0	59	70	62	3	2	16	3	2	2
Oregon	0	0	0	22	47	47	0	2	2	1	1	1
California	2	2	2	140	200	227	1	11	11	10	4	4
Total	21	17	18	4,595	5,620	6,662	63	382	371	73	107	107
6 weeks	203	102	124	25,951	31,802	36,535	[4] 453	2,385	1,828	476	661	698

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 10, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Whooping cough—Week ended Feb. 10, 1940	Whooping cough—Week ended Feb. 11, 1939
NEW ENG.		
Maine	77	63
New Hampshire	4	1
Vermont	47	26
Massachusetts	144	202
Rhode Island	13	55
Connecticut	61	76
MID. ATL.		
New York	394	508
New Jersey	95	461
Pennsylvania	341	466
E. NO. CEN.		
Ohio	92	216
Indiana	46	19
Illinois	80	410
Michigan [2]	115	189
Wisconsin	93	326
W. NO. CEN.		
Minnesota	25	56
Iowa	10	25
Missouri	15	10
North Dakota	18	10
South Dakota	11	2
Nebraska	4	10
Kansas	55	12
SO. ATL.		
Delaware	9	4
Maryland [2]	105	42
Dist. of Col	15	45
Virginia	57	70
West Virginia	6	25
SO. ATL.—continued		
North Carolina [3]	76	313
South Carolina [3]	6	106
Georgia [3]	38	20
Florida [3]	18	41
E. SO. CEN.		
Kentucky	60	10
Tennessee [3]	41	38
Alabama [3]	7	21
Mississippi [2]		
W. SO. CEN.		
Arkansas	6	11
Louisiana [3]	[4] 9	11
Oklahoma	4	2
Texas [3]	118	69
MOUNTAIN		
Montana	1	18
Idaho	5	1
Wyoming	2	1
Colorado	20	58
New Mexico	37	21
Arizona	26	5
Utah [2]	552	41
PACIFIC		
Washington	19	31
Oregon	36	12
California	154	92
Total	3,230	4,306
6 weeks	[4] 16,720	26,011

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Feb. 10, 1940, 19 cases as follows: North Carolina 2; South Carolina, 3; Georgia, 5; Florida, 1; Tennessee, 2; Alabama, 2; Louisiana, 1; Texas, 3.
[4] Later reports increase to 14 the number of reported cases of whooping cough in Louisiana for the week ended Jan. 20, and reduce to 2 the smallpox cases reported in Arkansas for the week ended Feb. 3. See Public Health Reports of Jan. 26 and Feb. 9, 1940, pp. 176 and 257.

WEEKLY REPORTS FROM CITIES

City reports for week ended Jan. 27, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	190	1,322	158	3,335	994	1,020	42	381	18	1,197	--------
Current week [1]	100	1,252	86	826	678	1,402	3	348	24	755	--------
Maine											
Portland	0	------	0	20	4	1	0	0	0	26	84
New Hampshire:											
Concord	0	------	0	0	1	0	0	1	0	0	10
Manchester	0	------	0	0	1	0	0	0	0	0	18
Nashua	0	------	0	4	0	0	0	0	0	0	6
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	4	0	0	0	0	0	0	0	0	11
Rutland	0	------	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	2	------	0	16	4	46	0	5	1	54	222
Fall River	1	------	0	6	1	3	0	0	0	7	27
Springfield	0	------	0	0	0	5	0	0	0	4	40
Worcester	0	------	0	1	14	13	0	0	0	1	68
Rhode Island:											
Pawtucket	0	------	0	0	0	1	0	0	0	1	16
Providence	0	------	1	92	8	6	0	1	0	3	71
Connecticut:											
Bridgeport	0	------	0	0	1	3	0	0	0	0	36
Hartford	0	1	0	0	1	3	0	0	0	2	35
New Haven	0	8	1	0	4	6	0	1	0	0	68
New York:											
Buffalo	1	------	0	2	9	7	0	11	0	8	149
New York	28	16	4	18	92	321	0	58	2	91	1,505
Rochester	0	1	0	1	3	12	0	1	1	11	70
Syracuse	0	------	0	0	9	11	0	1	0	27	63
New Jersey:											
Camden	2	1	3	0	4	3	0	0	0	0	41
Newark	0	6	1	3	8	16	0	11	0	12	126
Trenton	0	------	3	0	9	5	0	2	0	0	56
Pennsylvania:											
Philadelphia	1	51	4	8	42	69	0	25	3	56	615
Pittsburgh	6	22	10	2	17	54	0	4	0	2	201
Reading	0	------	1	0	0	0	0	0	0	8	25
Scranton	1	------	------	1	------	4	0	------	0	0	------
Ohio:											
Cincinnati	2	1	1	2	8	16	0	4	0	8	149
Cleveland	0	54	1	1	15	42	0	9	0	25	226
Columbus	0	1	1	0	9	17	0	2	0	8	105
Toledo	0	2	2	0	5	12	0	4	0	8	78
Indiana:											
Anderson	0	------	0	0	1	5	0	1	0	4	16
Fort Wayne	------	------	------	------	------	------	------	------	------	------	------
Indianapolis	2	------	0	3	17	10	0	4	0	7	120
Muncie	0	------	0	0	0	1	0	0	0	0	12
South Bend	0	------	0	0	0	0	0	0	0	0	17
Terre Haute	1	------	0	0	5	2	0	0	0	0	30
Illinois:											
Alton	0	------	0	0	4	1	0	0	0	0	13
Chicago	4	13	5	18	43	244	0	41	0	38	807
Elgin	0	------	0	0	1	5	0	0	0	3	7
Moline	1	------	0	0	0	4	0	0	0	0	16
Springfield	0	------	0	0	2	8	0	0	0	2	23
Michigan:											
Detroit	4	1	8	9	22	78	0	13	2	29	201
Flint	0	------	0	1	1	18	0	2	0	4	22
Grand Rapids	0	------	1	1	3	28	0	1	0	8	31
Wisconsin:											
Kenosha	0	------	0	0	1	6	0	0	0	1	12
Madison	0	------	0	0	0	2	0	0	0	2	8
Milwaukee	0	------	0	2	6	31	0	2	0	11	133
Racine	0	------	0	0	0	6	0	0	0	2	14
Superior	1	------	0	4	0	1	0	0	0	0	

[1] Figures for Barre, Fort Wayne, and Little Rock estimated; reports not received.

City reports for week ended Jan. 27, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Minnesota:											
Duluth	0		0	175	1	1	0	1	0	0	25
Minneapolis	1		2	8	8	19	0	2	0	9	114
St. Paul	0		0	0	10	22	0	0	0	19	62
Iowa:											
Cedar Rapids	0			15		5	0		0	0	
Davenport	0			0		4	0		0	0	
Des Moines	1		0	5	0	11	0	0	0	0	49
Sioux City	0			0		3	0		0	0	
Waterloo	0			1		2	0		0	1	
Missouri:											
Kansas City	0		0	1	18	16	0	2	0	0	124
St. Joseph	0		0	0	3	1	1	3	0	0	81
St. Louis	2	1	0	2	22	18	2	5	0	8	227
North Dakota:											
Fargo	0		0	0	0	1	0	0	0	0	10
Grand Forks	0			1		0	0		0	0	
Minot	0		0	0	0	1	0	0	0	0	6
South Dakota:											
Aberdeen	0			2		0	0		0	1	
Sioux Falls	0		0	0	0	2	0	0	0	0	6
Nebraska:											
Lincoln	0			2		1	0		0	0	
Omaha	0		0	5	6	2	0	2	0	0	7
Kansas:											
Lawrence	2	23	0	0	0	1	0	0	0	0	6
Topeka	0	1	1	0	4	4	0	0	0	0	21
Wichita	0	2	0	113	4	4	0	3	0	0	33
Delaware:											
Wilmington	0		0	0	4	7	0	1	0	6	36
Maryland:											
Baltimore	1	49	3	2	19	10	0	14	1	76	267
Cumberland	0		0	0	2	0	0	0	0	0	23
Frederick	0		0	0	1	1	0	0	0	0	11
Dist. of Col.:											
Washington	5	19	5	1	12	31	0	12	0	1	160
Virginia:											
Lynchburg	1		0	0	2	0	0	0	0	0	13
Norfolk	1	41	0	0	3	3	0	1	0	1	25
Richmond	0		2	0	6	1	0	3	0	0	57
Roanoke	0		1	1	1	6	0	0	0	0	28
West Virginia:											
Charleston	0	1	0	0	2	1	0	0	0	0	21
Huntington	1			0		3	0		0	0	
Wheeling	0		0	1	2	3	0	0	0	0	19
North Carolina:											
Gastonia	0			1		0	0		0	0	
Raleigh	0		0	1	1	1	0	0	0	0	9
Wilmington	0		0	0	1	0	0	0	0	0	11
Winston-Salem	0		0	1	1	2	0	1	0	0	10
South Carolina:											
Charleston	0	309	7	0	3	0	0	2	0	0	38
Florence	0		0	0	0	0	0	0	0	0	20
Greenville	0		0	0	0	0	0	0	0	0	2
Georgia:											
Atlanta	0	140	1	3	11	4	0	8	0	1	83
Brunswick	0		0	0	0	0	0	0	0	0	1
Savannah	0	250	2	0	3	3	0	2	0	0	38
Florida:											
Miami	1	5	0	0	6	0	0	0	0	0	45
Tampa	1		0	3	2	1	0	1	0	0	21
Kentucky:											
Ashland	1		0	1	1	0	0	0	0	1	5
Covington	2		0	0	3	1	0	1	0	0	16
Lexington	0		0	0	5	0	0	1	0	0	17
Louisville	0	11	0	1	8	9	0	3	0	56	92
Tennessee:											
Knoxville	0		0	0	2	11	0	1	0	1	31
Memphis	0	15	2	1	5	17	0	3	0	7	92
Nashville	0		1	9	10	1	0	4	0	1	87
Alabama:											
Birmingham	0	25	2	1	5	2	0	1	0	1	55
Mobile	1	17	1	0	3	2	0	1	0	0	25
Montgomery	1	30		15		1	0		0	0	

City reports for week ended Jan. 27, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	19		0		3	0		1	0	
Little Rock											
Louisiana:											
Lake Charles	1		0	0	0	0	0	0	0	0	9
New Orleans	8	39	1	0	26	13	0	12	3	9	194
Shreveport	1		0	0	12	0	0	6	2	0	69
Oklahoma:											
Oklahoma City	0		1	0	2	6	0	2	0	0	37
Tulsa	0			0		4	2		0	13	
Texas:											
Dallas	6	4	0	1	6	2	0	0	0	4	79
Fort Worth	0		0	1	8	7	0	1	0	6	49
Galveston	2		0	1	7	5	0	2	0	0	23
Houston	4	38	1	0	11	2	0	7	0	0	91
San Antonio	0	3	3	59	14	0	0	10	0	0	102
Montana:											
Billings	0		0	0	2	2	0	0	0	0	8
Great Falls	0		0	0	0	0	0	0	0	0	6
Helena	0		0	1	0	1	0	0	0	0	6
Missoula	0		0	0	0	0	0	0	0	2	6
Idaho:											
Boise	0		0	0	0	0	0	0	0	0	6
Colorado:											
Colorado Springs	0		0	0	0	2	0	0	0	0	18
Denver	7		3	5	11	7	0	3	0	2	99
Pueblo	0		0	0	4	0	0	0	0	4	17
New Mexico:											
Albuquerque	0		0	0	1	2	0	3	0	0	19
Utah:											
Salt Lake City	0		1	22	2	4	0	1	0	96	32
Washington:											
Seattle	1		0	112	5	7	0	2	0	17	114
Spokane	1	1	0	0	3	4	0	0	0	2	31
Tacoma	0		0	73	3	12	0	0	0	0	32
Oregon:											
Portland	2	36	0	30	6	8	0	2	0	10	84
Salem	0	1		5		0	0		0	0	
California:											
Los Angeles	3	156	2	13	10	36	0	24	0	12	358
Sacramento	1	5	3	0	8	2	0	2	0	0	37
San Francisco	3	4	2	1	11	19	0	8	0	18	204

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				Michigan:			
Boston	1	0	0	Detroit	1	1	0
Rhode Island:				Tennessee:			
Providence	1	0	0	Memphis	1	0	0
New York:				Louisiana:			
New York	1	0	0	Shreveport	0	1	0
Pennsylvania:				Idaho:			
Philadelphia	1	0	0	Boise	0	1	0
Pittsburgh	1	0	0	Utah:			
Ohio:				Salt Lake City	0	0	1
Toledo	0	1	0	California:			
Indiana:				Sacramento	0	0	2
Indianapolis	1	0	0				

Encephalitis, epidemic or lethargic.—Cases: Boston, 1; New York, 2; San Antonio, 1.
Pellagra.—Cases: Charleston, S. C., 1; Atlanta, 1.
Typhus fever.—Cases: New York, 1; Charleston, S. C., 1; Savannah, 1; Fort Worth, 1; Los Angeles, 1.

FOREIGN REPORTS

CUBA

Habana—Communicable diseases—4 weeks ended January 13, 1940.—During the 4 weeks ended January 13, 1940, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	11		Scarlet fever	2	
Malaria		1	Tuberculosis	5	2
Poliomyelitis	1		Typhoid fever	39	4

Provinces—Notifiable diseases—4 weeks ended January 6, 1940.—During the 4 weeks ended January 6, 1940, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	2			5		2	9
Diphtheria	1	17	1	2	1		22
Hookworm disease	1	48					49
Leprosy		12		1		2	15
Malaria	5	4	1	10	6	47	73
Measles			1	4			5
Scarlet fever		1					1
Tuberculosis	12	31	25	28	14	41	151
Typhoid fever	18	82	8	81	4	20	213

PANAMA CANAL ZONE

Notifiable diseases—October–December 1939.—During the months of October, November, and December 1939, certain notifiable diseases were reported in the Panama Canal Zone and terminal cities as follows:

Disease	October		November		December	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Chickenpox	4		11		13	
Diphtheria	19		12	1	8	
Dysentery (amoebic)	9	2	17	2	14	3
Dysentery (bacillary)	15	14	8	6	5	
Leprosy	1		1	1		
Malaria	83	2	125	6	196	8
Measles	2		4			
Meningitis, meningococcus			1			
Mumps			1			
Paratyphoid fever			2		1	
Pneumonia		12		16		25
Poliomyelitis			1		1	1
Relapsing fever			2			
Scarlet fever	3					
Tuberculosis		40		18		42
Typhoid fever			1		2	

SWEDEN

Notifiable diseases—November 1939.—During the month of November 1939, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	2	Poliomyelitis	49
Diphtheria	54	Scarlet fever	3, 182
Dysentery	9	Syphilis	40
Epidemic encephalitis	1	Typhoid fever	3
Gonorrhea	913	Undulant fever	8
Paratyphoid fever	19	Weil's disease	10

YUGOSLAVIA

Communicable diseases—4 weeks ended December 31, 1939.—During the 4 weeks ended December 31, 1939, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	13	4	Paratyphoid fever	19	
Cerebrospinal meningitis	45	10	Poliomyelitis	2	2
Diphtheria and croup	854	79	Scarlet fever	362	7
Dysentery	7	3	Sepsis	8	5
Erysipelas	219	10	Tetanus	13	10
Favus	13		Typhoid fever	428	35
Leprosy		4	Typhus fever	20	3

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of January 26, 1940, pages 182–186. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

India—Madras.—During the week ended January 27, 1940, 1 case of cholera was reported in Madras, India.

Plague

Egypt—Asyut Province—Abutig District.—During the week ended January 27, 1940, 11 cases of plague with 3 deaths were reported in Abutig District, Asyut Province, Egypt.

Yellow Fever

Colombia—Antioquia Department.—Yellow fever has been reported in Antioquia Department, Colombia, as follows: Caracoli, December 24, 1939, 1 death; Jordan, December 1, 1939, 1 death; San Carlos, December 16, 1939, 1 death.

French Equatorial Africa—Fort Archambault.—On January 26, 1940, 1 fatal case of suspected yellow fever was reported in Fort Archambault, French Equatorial Africa.

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Public Health Reports

VOLUME 55 FEBRUARY 23, 1940 NUMBER 8

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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A FURTHER STUDY OF THE MODE OF ACTION OF METHYLCHOLANTHRENE ON NORMAL TISSUE CULTURES

By WILTON R. EARLE, *Cytologist*, and CARL VOEGTLIN, *Chief, National Cancer Institute, United States Public Health Service*

In a previous paper (*5*) the authors described the action of 20-methylcholanthrene on a series of tissue cultures of fibroblasts from the abdominal musculature of an adult mouse. These cultures were grown in a medium which consisted of horse serum, chick embryo juice, and a physiological saline. The record of these cultures was carried to 59 days, or, in other words, to 54 days after the first addition of the drug. The present paper is concerned with the later history of this series of cultures (series 188), and carries the record up to a total time of 380 days after the first addition of methylcholanthrene.

The data on cultures of series 188 have also been supplemented and confirmed by data from two other series of cultures (series 189 and 191). Data on these two series are presented up to 262 and 252 days, respectively, after first addition of methylcholanthrene to the cultures. At this time all three series of cultures were closed owing to a bacterial infection which had occurred a few days previously.

All of these cultures subjected to the methylcholanthrene showed characteristic changes in the cells. These changes persisted after the addition of methylcholanthrene to the cultures was discontinued and the cultures were shifted into fresh medium.

MATERIALS AND METHODS

The general methods used in this study and the conditions of handling the cultures for all three series are those previously outlined. For more detailed information reference is made to the previous paper (*5*). It may be emphasized that at no time during the life of these cultures were they subjected to white light and even after discontinuance of the methylcholanthrene all cultures were handled and examined only under light of wavelengths of 480 mμ or longer.

As outlined in the previous paper, series 188 consisted of 5 sets of cultures, each set including 6 cultures. The cultures were all originally

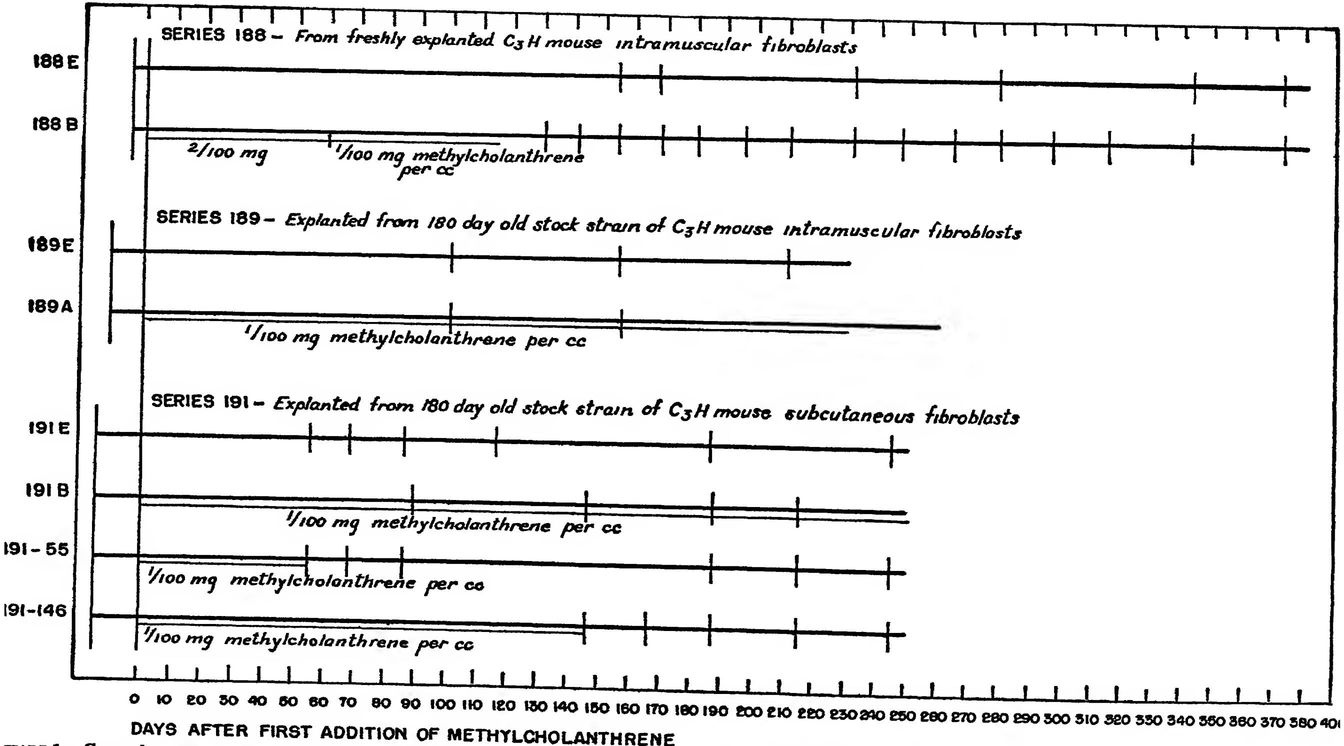
from freshly explanted strips of the entire thickness of the abdominal musculature of C_3H mice. These sets were designated A, B, C, D, and E, respectively, and were subjected to culture fluids carrying concentrations of 0.1, 0.02, 0.002, and 0.0002 mg. of highly purified methylcholanthrene for each cubic centimeter of culture fluid, respectively, for the first four sets. At about 60 days, set B was reduced from 0.02 mg. to 0.01 mg. This concentration was continued through the rest of the time the cultures were left in contact with the carcinogen. Set E received no methylcholanthrene and served as a control. In all cultures which received the carcinogen it was added in the form of a fine suspension in the culture medium.

Series 189 was explanted as strips about 1×15 mm. in size, all cut from a stock culture originally explanted about 180 days earlier from the dorsal musculature of a C_3H adult male mouse. Growth of fibroblasts from these strips was excellent. In this series 26 cultures were started, of which 3 received no methylcholanthrene and served as controls. These 3 will be designated as set 189–E. The remainder of the cultures, which will be designated as set 189–A, were started on 0.01 mg. of methylcholanthrene per cubic centimeter of culture fluid 11 days after explantation into fresh flasks. This concentration of methylcholanthrene was continued, as noted below, up to a total time of 230 days after first addition of the carcinogen to the cultures.

Series 191 was originally explanted from stock cultures of adult C_3H mouse subcutaneous connective tissue fibroblasts which had been carried in culture in the above described culture medium for about 180 days. Strip cultures similar to those of series 188 and 189 were used as explants. These were transferred to 29 fresh flasks. Methylcholanthrene was added in these cultures 15 days after this explantation. As in series 189, 0.01 mg. of the carcinogen was used in each cubic centimeter of fluid culture medium. These cultures will be designated as culture set 191–B. A group of 6 control cultures was also started. This control group was not subjected to methylcholanthrene and will be designated as culture set 191–E.

To allow ready comparison of the conditions used in these cultures, the respective culture conditions and transfer frequencies have been summarized in chart 1.

In some older work, never reported, a study was made of the characteristics of several strains of cells isolated from rat tumors which arose subcutaneously in Wistar rats following the injection of about 10 mg. of methylcholanthrene in each rat. All tumors arose at the injection sites. One strain of these tumor cells was carried for more than 90 days in culture in the same standard medium previously described (*5*). This strain was finally closed for lack of immediate use. The cells of this strain are compared briefly with the mouse cells treated with methylcholanthrene *in vitro*.



HART 1.—General course of series 188, 189, and 191 cultures The time during which the cultures were carried is indicated by the heavy black horizontal lines Th time during which methylcholanthrene was added to the cultures is shown by the light horizontal lines under the heavy lines Transfers to fresh flasks are indicate by short vertical lines. Culture series and sets are designated at the left of the chart.

CONTINUED HISTORY OF THE CULTURES OF SERIES 188

At the end of about 60 days after the first addition of methylcholanthrene, a number of the cultures, particularly in set A, had died or were in such poor condition that it was useless to carry them longer. In sets C and D a number of the cultures were sacrificed for examination and several were lost through accident. No cultures were sacrificed from set B, however. Since it was desired to keep exposure of the cultures to light down to the lowest practicable level in the period from 60 to 114 days after first addition of the carcinogen, the cultures were subjected only to infrequent brief microscopic examination.

At 98 days after first addition of the carcinogen it was observed that through all the methylcholanthrene-treated cultures there was a noticeable amount of cell disintegration. In the controls there was markedly less. In sets C and D there was practically as much disintegration of the cells as was seen in the surviving cultures of sets A and B. In all of the living cultures, however, occasional cells in division were seen.

Degeneration became increasingly severe with age, until at about 115 days after methylcholanthrene was first added to the cultures their condition was such that it seemed unsafe to carry them any longer in the carcinogen. At this time the series consisted of 1 culture from set A, 3 from set B, and 1 from set D. The A and D cultures were in extremely poor condition. The addition of methylcholanthrene to the cultures was therefore discontinued. Fifteen days later the cultures were all removed from the respective flasks and representative strips cut from them. These strips were rinsed in saline and then explanted into fresh culture medium to which no methylcholantrene was added.

Of these various cultures, those from sets A and D both died. One culture from set B was lost by accident. A second culture from set B showed some growth, but on a later transplantation showed only sparse growth and soon died. The last culture of set B, when it was transplanted, was transferred as 3 strips, each to a separate flask. Each of these strips grew satisfactorily. The control flasks, from a culture of set E transplanted at the same time, grew in their usual luxuriant manner.

Within a very few days after the transplantation it was obvious that the growth of the carcinogen-treated cells of the 3 surviving cultures was quite different from that of the controls transferred at the same time. Whereas the controls showed their usual luxuriant, somewhat loose growth of clear, nongranular cells of relatively uniform size and spindle shape, the carcinogen-treated cultures showed a smaller growth area of extremely granular cells. These cells manifested great irregularity of size and shape. In contrast to the cells of the controls, these cells seemed to have a greater tendency to assume rounded, or

circular, flattened shapes. The general nature of this difference is shown by comparison of two later photographs, figures 2 and 3.

Since it was certain that at least traces of carcinogen remained in the cultures, they were subjected to only very limited examination for about 90 days after this first explantation, for fear that excessive exposure to light might have an injurious action. All of these examinations were made under light of 480 $m\mu$ wavelength or longer.

An examination of these cultures 25 days after omission of methylcholanthrene and 10 days after transfer to fresh flasks showed that, whereas the controls were growing well and were forming rather diffuse cultures of cells free from gross granulation and necrosis, the cultures which had been treated with the carcinogen still tended to form a fairly dense growth of distinctly more granular cells. This growth already showed marked evidence of central necrosis and also showed some slight diffuse peripheral necrosis. At this time the cultures were transferred to fresh Carrel flasks and continued growing, without, however, losing characteristic differences from the controls. A representative area of a carcinogen-treated culture, photographed at 38 days after discontinuance of the carcinogen, is shown in figure 3, and may be compared with figure 2, a typical control culture.

Up to June 22, 1939, these cultures had been carried 265 days after the carcinogen was first omitted. During this time they were transferred to fresh flasks from 13 to 15 times, different cultures having had slightly different intervals of subculture. After the first transfer the cultures grew rapidly. In addition to these 13 to 15 complete changes of culture medium, each culture was soaked for at least 1 hour, with 1-cc. lots of saline at each culture fluid change. This totaled more than 100 washings for each culture. Each culture also received more than 100 fresh 1-cc. lots of fluid culture medium. These lots were each left in the flask from 2 to 3 days. In spite of these numerous changes of culture fluid, with necessary consequent reduction of methylcholanthrene concentration in the cultures to extremely low levels, this strain of cells maintained a characteristic morphology and physiology quite different from that of the controls. The differences observed between the methylcholanthrene-treated strain and its controls, as characterized in cultures of from 160 to 260 days after discontinuance of the methylcholanthrene, are summarized below. A comparison is also made of these 2 cell strains with a strain of rat sarcoma cells which arose from the injection of methylcholanthrene and which were carried in culture for more than 90 days.

1. After explantation the rate of increase in the diameter of the carcinogen-treated culture was slower than was that of the control. This is illustrated in chart 2, which shows data from a group of 4 control cultures and a group of 6 carcinogen-treated cultures of series 188. The data presented in this chart were obtained from 165 to 181

days after removal of the cultures from the carcinogen. In respect to this relative retardation of the rate of increase of diameter of the culture, the carcinogen-treated cultures were similar to cultures that were studied from the tumors induced in rats by injection of methylcholanthrene.

2. The control cells from set E had the tendency to form rather loose cultures with very diffuse edges. The carcinogen-treated cells tended

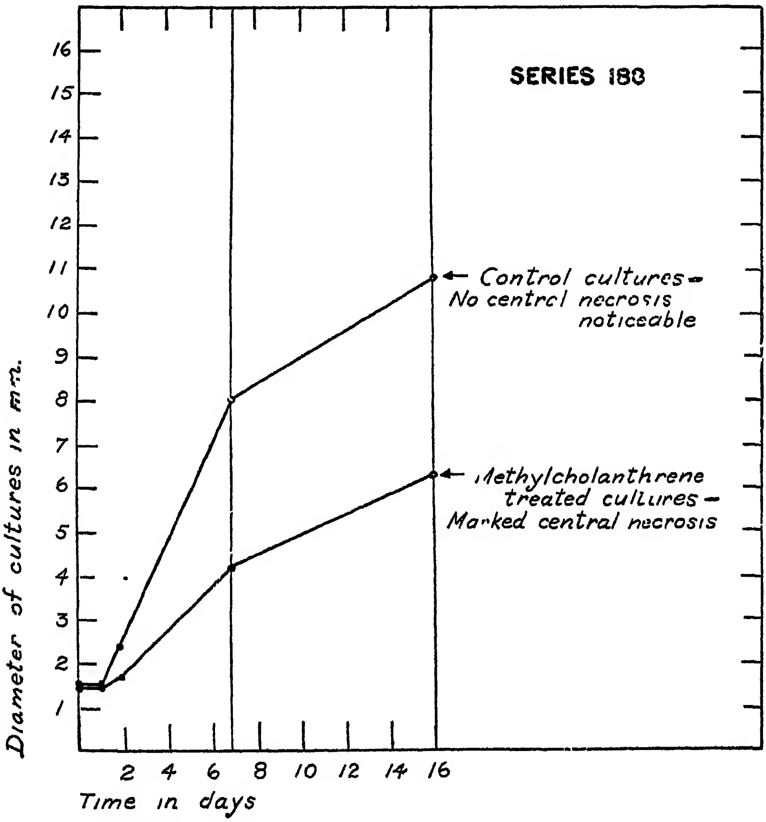


CHART 2.—Curves showing the rate of increase in the diameter of carcinogen-treated cultures and controls. The control set consisted of 4 cultures from series 155, the carcinogen-treated set included 6 cultures. Curves were started at 165 days after omission of the carcinogens.

to form extremely compact cultures with sharply defined edges. This difference is illustrated in figures 1 and 4 which show representative control and carcinogen-treated cultures. The carcinogen-treated culture here shown was taken at 67 days after removal from the carcinogen, and 13 days after the last transfer to fresh flasks. This dissimilarity of culture architecture was regularly seen even when the two cultures were grown side by side in the same flask. An instance of this is shown in figure 7. In this figure are shown two such cultures

growing under identical conditions in the same culture flask. The small dense culture is from series 188 carcinogen-treated cells, about 172 days after the carcinogen was omitted. The larger, diffuse culture is a control. Both cultures had grown in this flask about 7 days when the photograph was taken. In figure 6 is shown a low-power view of a 7-day culture from the fifth *in vitro* generation of a rat sarcoma induced by methylcholanthrene. In spite of the difference in the lighting of the cultures, the remarkable similarity of this type of culture architecture to that of the carcinogen-treated culture is readily seen by comparing figures 6 and 7, while the equally notable difference from the architecture of the control culture is also easily seen.

3. While the control cultures grew for quite long periods of time with practically no central necrosis, the carcinogen-treated cultures showed marked central necrosis at about 15 to 20 days after explantation. This is illustrated, for instance, in chart 2. In this respect the carcinogen-treated cultures were definitely similar to cultures of sarcoma which we have examined and which arose from intramuscular or subcutaneous injections of methylcholanthrene into rats.

At about 15 to 20 days after the transfer of carcinogen-treated cultures there was often a very slight diffuse necrosis throughout the cultures. Frequent mitoses were observed, often in close juxtaposition with necrotic cells. This same phenomenon was also observed in the rat sarcoma cultures.

This difference in the necrosis rate and necrosis design of the methylcholanthrene-treated cultures and their controls was even more clearly shown in two sets of slide cultures which were examined. After the original explantation these two sets received no fresh culture medium. Consequently, unlike the flask cultures, on which medium was changed every 2 days, the slide cultures used their medium to exhaustion. In these cultures, at 5 days after explantation, all of the methylcholanthrene-treated cultures were entirely necrotic. In the control cultures, in some of which the cell clump was of substantially larger size, the cells were merely rather granular, and sometimes slightly rounded. There was no general necrosis.

4. While the control cultures showed cells extremely free from granulation and fat droplets, the carcinogen-treated cells showed a definite tendency to greater granularity and a greater amount of small fat droplets. This may be seen, for instance, by comparison of figure 2 with figures 3, 5, 12, and 14. This same tendency was also characteristic of the cultures of methylcholanthrene-induced rat tumors which we have examined.

5. In the control cultures the cells had a tendency to form slightly flattened spindle shapes, often with long terminal threads at the ends of the cells. This may be seen in figures 1, 2, and 11. There was

often a characteristic connection of the cells by these terminal processes. In the methylcholanthrene-treated cultures, these long, slender terminal processes were almost entirely absent, and even when seen, as in figure 12, appeared shorter and less slender than usual. The terminal processes of these carcinogen-treated cells were short, blunt, often lobulated, ameboid, irregular membrane-like. Various forms of this growth may be seen in figures 3,[1] 5, 10, 14, and 15 In this respect, they were quite similar to the cultures of methylcholanthrene tumor cells, as may be seen from figure 9

6. In the control cultures the cells showed a general tendency to remain laterally discrete from one another, as may be seen from figures 1, 2, and 11. In the carcinogen-treated cultures there was a definitely marked lateral adhesion of the cells to one another. This lateral cohesion of the cells was manifested by the formation of broad ribbons of cells, and, commonly, sheets of cells These may be seen in figures 3, 5, 10, 13, 14, and 15.

Where the cells were terminally joined to each other to form ribbons of cells, these ribbons were of relatively uniform diameter along their length and without great constriction in passing from one cell to the next, as shown in figure 12. These ribbons were sometimes quite long and smooth. In other cultures they were quite irregular, arborescent, with irregular branchings. Different types of this ribbon structure may be seen in figures 10 and 12. In numerous instances long ribbons extended out into the culture medium, then turned, and the peripheral end finally joined with the mass of the culture, or with another ribbon, and so produced an enclosed area of culture medium. In further growth of the culture this frequently gave the extreme appearance of a fenestrated cell layer, as shown in figures 13 and 14, where just such a process of enclosure has taken place.

Where sheets of cells occurred the constituent cells of the sheets were so closely adherent as often to appear as epithelial sheets with typical epithelial-like edges. These edges were lobulated, ruffled, or in some cases showed strands or ribbons of cells. These forms may be seen in figures 4, 5, and 15. We have seen similar sheets in cultures of the Walker 256 rat mammary carcinoma. We have not, however, so far observed this striking lateral adhesion with sheet formation in nearly so clear a form in cultures from methylcholanthrene-induced rat tumors. It was usual in these tumor cells, however, to see the degree of cohesion shown in figures 8 and 9.

7. Whereas in the control cells there was often a slight rippling of the extreme terminal processes of the cells, in the methylcholanthrene-treated cells, as may be seen from figure 15, this rippling was often extremely prominent and extended, in numerous instances, well up

[1] The thread like objects seen in figure 3 are not all processes but are due to a badly scratched Carrel flask.

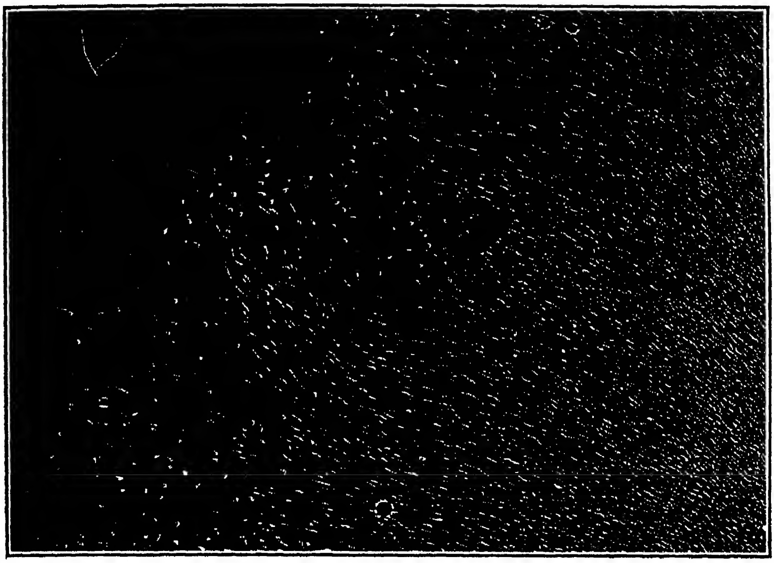


FIGURE 1 —Control culture from series 188 Low power to show general structure of the culture Note looseness of the culture the spindle shape of the cells their long slender terminal processes and the lack of lateral cohesion The photograph was taken when the carcinogen treated cells of the series had been removed from the carcinogen for 172 days The culture was transferred to a fresh flask 7 days earlier This figure and figure 2 are representative of the control cultures While controls were carried on all cultures, the appearance of all controls was so similar they will not be presented except to illustrate some special point × 38

FIGURE 2 —A higher power view of a control culture from the same set of series 188 This culture was taken 172 days after the carcinogen was omitted from the treated cultures and 7 days after the last transfer to fresh flasks Note the characteristic cell shape, long slender terminal processes, and lack of lateral cohesion × 290

FIGURE 3.—Carcinogen treated culture of series 188, 38 days after the carcinogen was omitted and 14 days after transfer to fresh flask. Note irregular cell size and much granulation within the cells. The large cell in the center seemed to have three nuclei. × 2[illegible]0

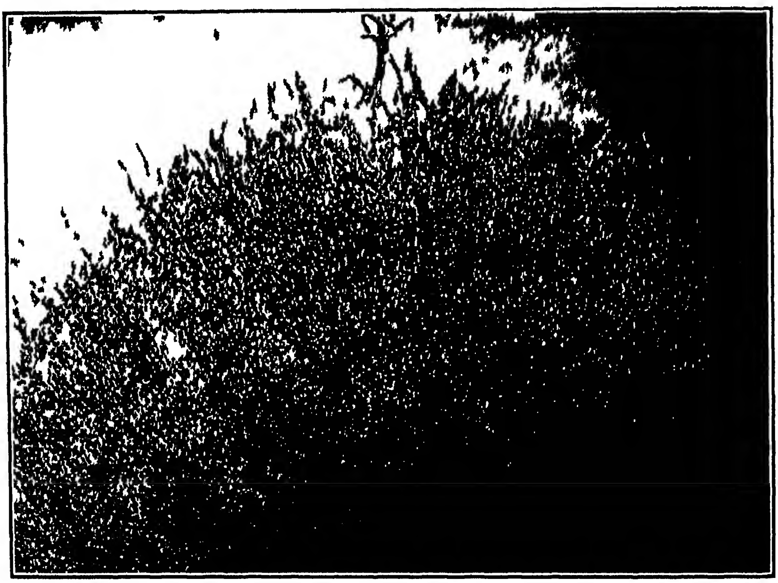


FIGURE 4.—Carcinogen treated culture from series 188 at 67 days after discontinuance of the carcinogen and 13 days after the last transfer to fresh flasks. Note the density of the culture, the sharpness of the edges of the culture, and the epithelial like character of the growth resulting from lateral cohesion of the cells. × 38

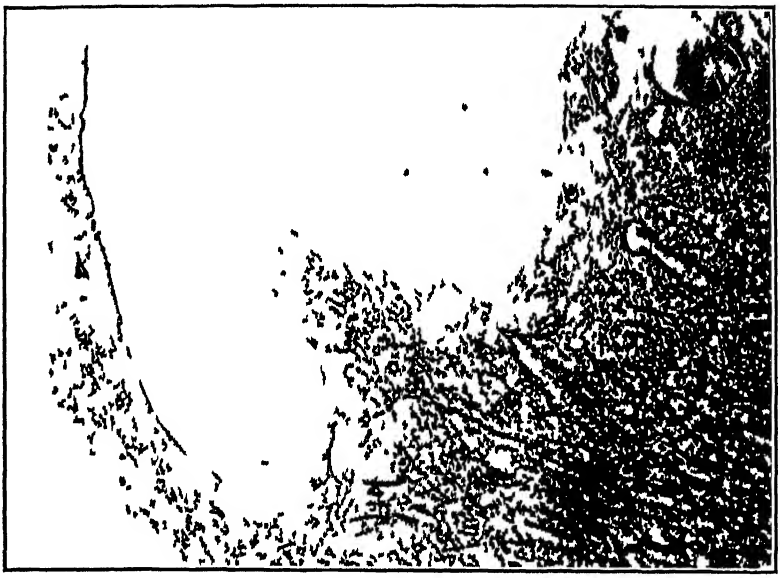


FIGURE 5.—Higher power of culture of carcinogen treated culture from the same set as in figure 4. Note the epithelial like lobes of cells. × about 250.

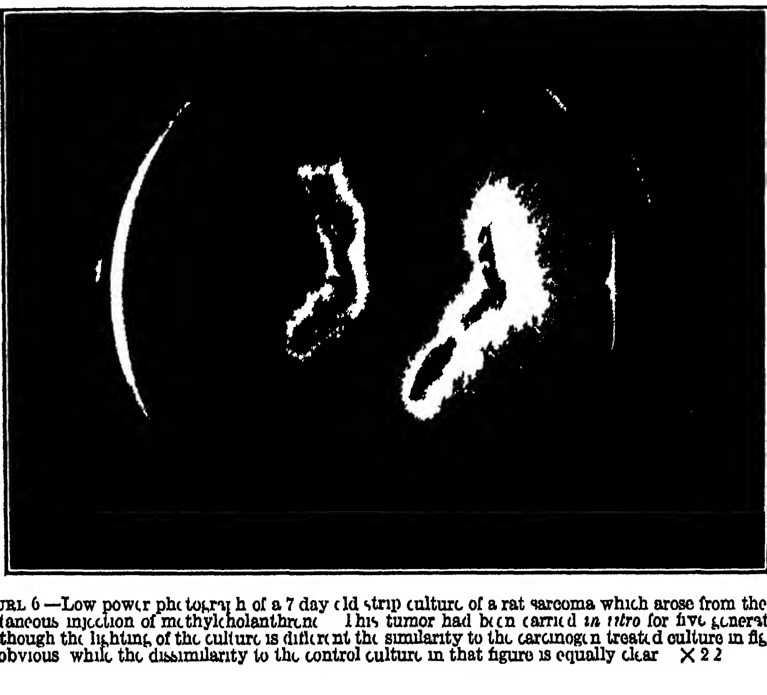


FIGURE 6.—Low power photograph of a 7 day old strip culture of a rat sarcoma which arose from the subcutaneous injection of methylcholanthrene. This tumor had been carried *in vitro* for five generations. Although the lighting of the culture is different, the similarity to the carcinogen treated culture in figure 7 is obvious, while the dissimilarity to the control culture in that figure is equally clear. × 2.2.

FIGURE 7.—Low-power photograph of a carcinogen-treated culture and a control, both from series 188, growing side by side in the same flask. This photograph was made about 172 days after the carcinogen was discontinued from the carcinogen-treated culture and about 7 days after both cultures were explanted to this flask. × 6.5.

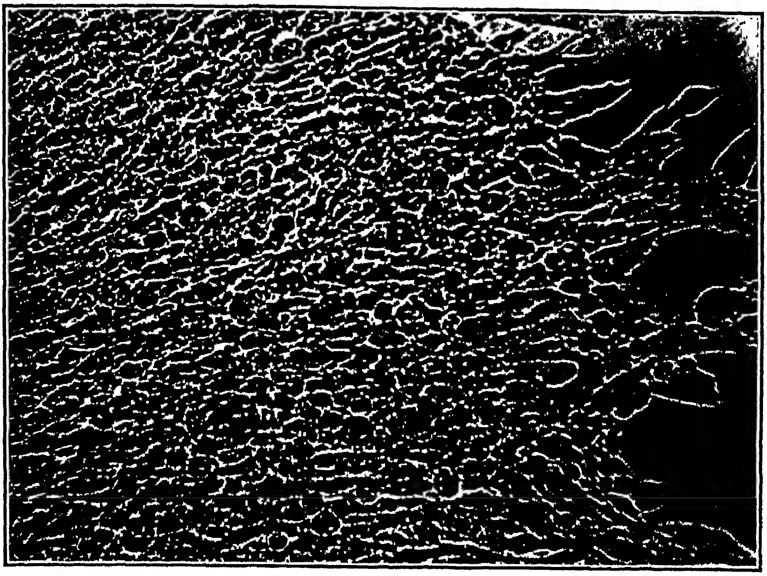


FIGURE 8.—General cell arrangement in a culture of a rat tumor which originated from the action of methylcholanthrene. Note the density of the culture and the sharpness of its outer edges. Note the presence of some lateral adhesion of the cells and the similarity of these features to those of figures 10 and 14.

FIGURE 9.—Higher power view of the same culture, from a rat sarcoma, shown in figure 8. Note the lack of long slender terminal processes on the cells, the tendency toward amoeboid edges, and the granularity of the cells. Note the similarity of the cells to those shown in figures 10 and 14. × 290.

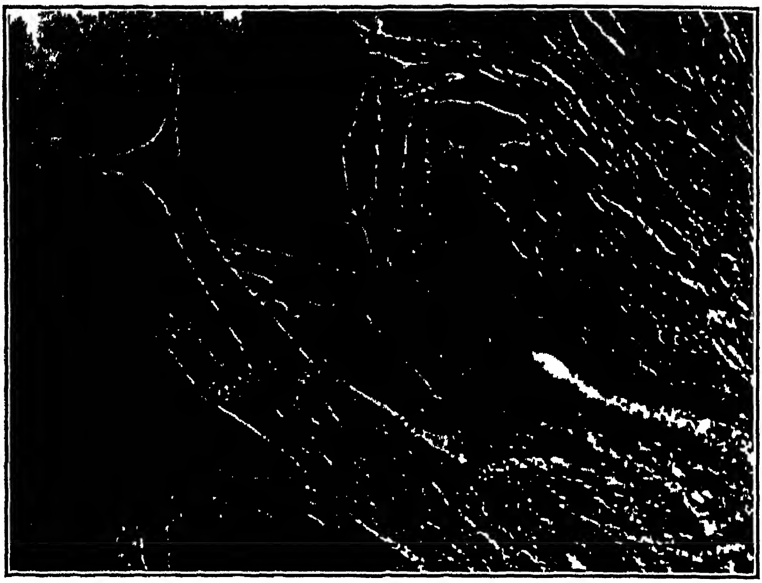


FIGURE 10 —Carcinogen treated culture from series 188 133 days after removal from the carcinogen and 1 day after explantation to a fresh flask Note the lateral adhesion of the cells the formations of long ribbons of cells, the absence of long slender terminal processes and the amoeboid edges of the cells × 290

FIGURE 11 —Control on culture shown in figure 10, 1 day after transfer to fresh flask Note the lack of lateral adhesion of the cells, the long slender cell processes, and the relative absence of amoeboid ruffling of the cell edges × 290

FIGURE 12 —Culture from series 188, 162 days after omission of the carcinogen and 7 days after explantation to a fresh flask Note the ribbon or rod like structure of the cells Note also the granulation within the cells × 200

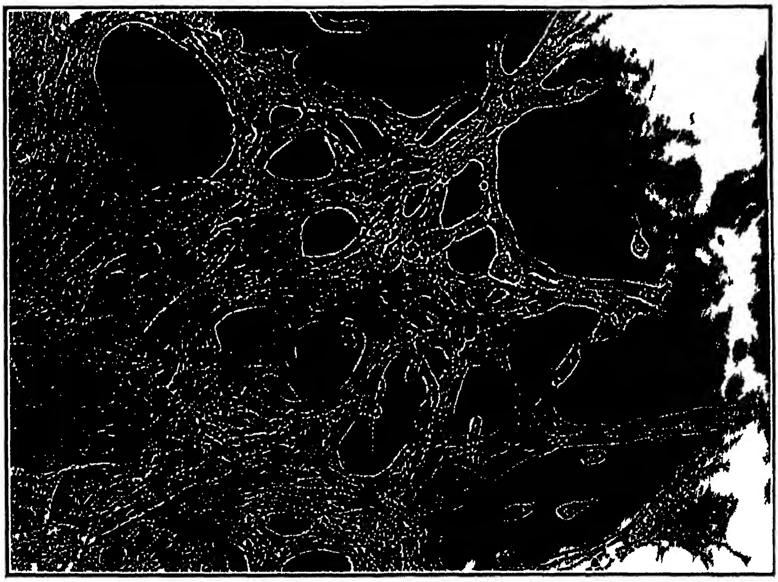


FIGURE 13 —Culture from series 188 265 days after omission of the carcinogen and 7 days after last transfer to fresh flask Note the ribbon like structure of the edge of the culture and the enclosure of spaces by growing ribbons of cells × 200

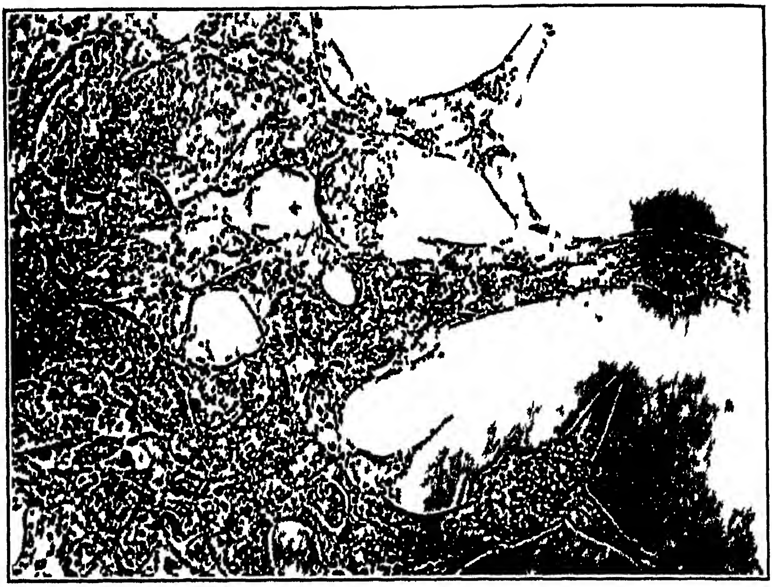


FIGURE 14 —Culture from series 188 162 days after omission of the carcinogen and 7 days after last transfer to fresh flask A higher power photograph of such an area as that shown in figure 13 X 2[illegible]0

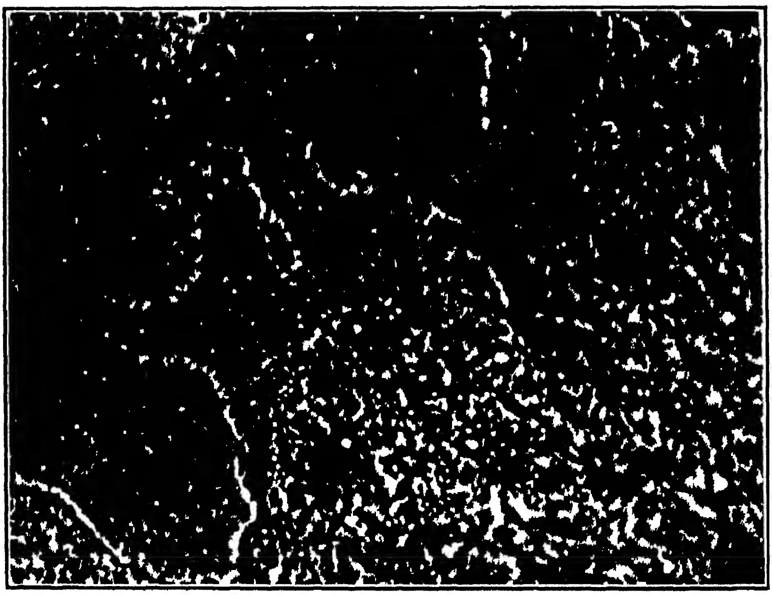


FIGURE 15 —Edge of epithelial like sheet in carcinogen treated cultures of series 188, [illegible]7 days after discontinuance of carcinogen and 12 days after last transfer to fresh flask Note the epithelial like lobes of the sheet and the rippling of the edge of the sheet X 720

FIGURE 16.—Carcinogen treated culture from series 191–14[illegible]. This culture was carried 106 days after the carcinogen was omitted and the photograph was taken 7 days after the last transfer. Note that in this area the general architecture of the culture is that of interlacing ribbons of cells. Note that the [illegible] lie at all planes within the plasma clot. × 144.

FIGURE 17.—Carcinogen treated culture from series 191–14[illegible], 106 days after the carcinogen was omitted and 7 days after last transfer. Note that almost the whole field consists of a more or less continuous sheet of laterally adherent cells. × 144.

the sides of the cells. This was seen even in long, slender cells. This rippling, in some instances, was quite extreme. Actual pinocytosis was never observed in methylcholanthrene-treated cultures although it was observed in methylcholanthrene-induced tumor cultures.

8. While in the control cultures, even at an advanced age, there was great uniformity of cell size, in the carcinogen-treated cultures there was a great irregularity in the size of various cells at an extremely early age in the growth of the culture. This may be illustrated by a comparison of figures 2 and 3. It may be noted that this change was also observed in cultures of cells from tumors which resulted from the injection of methylcholanthrene into rats.

At about 83 days after removal of the cultures from methylcholanthrene, a total of 12 mice were injected with one culture each of these carcinogen-treated cultures. In no instance did there result a growth of any type, although all mice were held for at least 180 days after injection.

HISTORY OF SERIES 189

Series 189, for the same reasons as outlined for series 188, was examined only infrequently during the first 100 days of its growth. During this time there was noted some degenerative action from the methylcholanthrene but not sufficient to result in the destruction of the cultures. There was obvious retardation of the growth, however, as the treated cultures grew at a substantially slower rate than did the controls. This slower rate was evident in both the lesser diameter and lesser density of the carcinogen-treated cultures. Because of the increased degeneration of the cultures in the same flask with the passage of time, the cultures were transferred to fresh flasks at about 101 days after the first addition of carcinogen. Methylcholanthrene was immediately added to each subculture of this series.

In the first subculture in the presence of methylcholanthrene, the cultures which received the carcinogen showed a striking retardation of the rate of increase in the diameter of the cultures when compared with control cultures. This retardation was quite comparable to that shown in chart 2 for series 188. In spite of this retardation in the rate of increase in the diameter of the culture frequent mitoses were observed. As with series 188 and 191, growth was very dense. The cell forms and characteristics were quite similar to those observed for series 188 and 191.

Except for the loss of a few cultures from this series as a result of accident, all cultures survived until this first transfer. Later sub-culturing, with division of the cultures, increased the length of the series substantially and could have increased it even further. Owing to limited facilities for handling large numbers of cultures this series

was later reduced to about 10 cultures, all derived from a single original culture.

While the increase in diameter of all of these cultures was slower than that of the controls, it was still sufficiently rapid that cultures were routinely obtained from which 8 healthy explants could be cut.

Since this series was still being carried in methylcholanthrene at the time it was closed owing to bacterial infection, it will not be considered further. Insofar as this series was followed it apparently ran an identical course with series 188 and 191.

HISTORY OF SERIES 191

Series 191 consisted of stock fibroblasts of subcutaneous origin. This series followed a course generally parallel with that of series 188 and 189. After addition of the carcinogen to the cultures there was some degeneration within about 30 days. From this time on through the first transfer generation the diameters and densities of the cultures were substantially less than of the controls. Mitoses were sometimes observed but were not studied closely.

These cultures were transferred to fresh flasks at different intervals from 88 days after the carcinogen was first added. In these new flasks, except for the 2 cultures noted below, the carcinogen was continued. In chart 1 the set of cultures which was continued in carcinogen is designated as 191–B. In this second transfer generation and in later generations in the presence of methylcholanthrene the culture diameters, as in series 188 and 189, increased at a rate slower than those of the controls. In these carcinogen-treated cultures the cell density was substantially increased. As with the earlier series the presence of extensive necrosis was less prominent than during the first generation in all cases where cultures were transferred to new flasks at least every 15 days. For freshly transplanted cultures there was little marked degeneration in the zone of migrating cells.

At 55 days after first addition of methylcholanthrene to the cultures, the carcinogen was omitted from one culture, No. 5. From that time on and in subsequent transfers no more carcinogen was added to this culture. The course of this culture is shown in chart 1, set 191–55. This culture strain continued to show recognizable lateral adhesion of the cells 170 days after the addition of the carcinogen was discontinued. At 145 days after the first addition of the methylcholanthrene, culture No. 23 of set 191–B was subdivided into 6 cultures. Of these, 3 were carried on in the carcinogen as a group of set 191–B, and 3 were removed from the carcinogen and were thereafter transferred with no further addition of carcinogen. These 3 are designated in chart 1 as cultures 191–146. These cultures, all originally from culture No. 23, totaled 22 at the time the series was closed

because of bacterial infection. Of these, roughly half were being carried on in carcinogen, while the other half received no carcinogen after 146 days. Up to the time the series was closed, that is, 250 days after first addition of carcinogen to the cultures and 105 days after addition of carcinogen was discontinued in half the set, no marked difference could be detected between cultures of the two halves of the set. Both halves were radically changed from the controls.

The following comparison may be made of the carcinogen-treated cultures of series 188 with those cultures of series 191 which were removed from the carcinogen after 145 days and then carried 90 days in culture media to which no carcinogen was added.

1. While actual growth curves were not made, it appeared that the rate of increase of the diameters of these cultures from series 191 was even slower than that of any of the other carcinogen-treated cultures. It was certainly slower than that of any of the control sets. In fact, for the first 30 days after removal from the carcinogen doubts were experienced as to whether the strain would continue to live. Later, however, the growth rate seemed to improve slightly.

2. Carcinogen-treated cultures of series 188 had a definite tendency toward lateral cohesion with resultant formation of cell ribbons and sheets of limited area. Many loose cells were seen at the edges of some cultures, though these cells did not show long terminal processes. In this set of series 191, however, the tendency to lateral adhesion was far more exaggerated. Extremely few loose cells wandering out from the culture were seen. All cultures showed one, or both, of two general types of architecture. The less frequent of these types is shown in figure 16 and consisted of an interlacing meshwork of cells, probably a modified form of the cell ribboning seen in the earlier cultures. In figure 17 is shown the more typical, and generally the only, type of architecture seen in the cultures. The growth here was generally that of a very closely fused epithelial sheet. Even when clumps of cells had floated loose from the main clump and had re-anchored themselves on the surface of the clot at a distance there was an almost complete absence of spindle forms. In all instances the cells were sheet-like, coherent. The photographing of these cells was quite difficult owing to the fact that they were spread out so thin that their edges formed very poor refractive images. These two forms of cell growth were not limited to the fluid interface of the clot; they were of regular occurrence both on the glass and fluid interfaces and also within the body of the clot itself.

3. The prevalence of central necrosis in the culture after about 15 days was at least as great as that in the carcinogen-treated cultures of series 188 and was far more accentuated than in the controls of either series.

4. The tendency of the cells to show increased granulation appeared quite as accentuated as in the carcinogen-treated cells of series 188, but not more so. They possibly showed fewer fat droplets.

5. In an examination of the carcinogen-treated cultures of series 188, all appearances of the cultures suggested that the carcinogen-treated cells were far more labile organisms than the cells of the control cultures, and were quite similar in this respect to those of the carcinogen-induced sarcomas studied in the rat. With cultures of series 191 this increase in lability appeared even more accentuated. Aberrant cell forms were more common at earlier stages after transplantation to fresh flasks. There was also more diffuse necrosis at earlier stages.

6. In both series numerous mitoses were observed.

It may be noted that although the controls of series 191 showed just a trace of lateral cell cohesion, which was almost certainly due to traces of contamination with methylcholanthrene from the glassware, nothing like the degree of change observed in the cultures deliberately treated with carcinogen was ever observed in the controls.

One point is of marked interest in connection with both series 189 and 191. In both of these series the cultures that were treated with the carcinogen showed at all times loose crystals of methylcholanthrene lying around, through, and on the plasma clot of the culture medium. While in the early stages of the cultures subjected to the carcinogen there had appeared a degenerative action of the carcinogen on the cells, in the later stages it was the usual thing to see these carcinogen crystals in close juxtaposition with, or surrounded by, cells which were quite as healthy as other cells situated at a distance from the crystals. Further examination of the cultures showed numerous cells which actually contained crystals of the carcinogen. In one instance a cell was seen with a crystal the length of which was roughly four times the diameter of the average cell in the culture. The cell which surrounded this crystal was much larger than usual. It showed a clear periphery with a very granular cytoplasm just surrounding the nucleus and the crystal. The relation of the crystal and the cell was so clearly defined that there could be no question that the crystal lay actually within the cell itself.

DISCUSSION

Creech (2) studied the effect of methylcholanthrene and of 1:2:5:6-dibenzanthracene choleic acid on fibroblasts of the tissue surrounding the ribs of embryonic mice. For each cubic centimeter of culture medium 0.01 mg. of carcinogen was used. The cultures were grown in hanging drop preparations in chicken plasma, chick embryo extract, and saline. Cultures were studied at 44 to 45, and at 70 hours. The relative areas of the cultures studied were determined and the number

of mitoses counted. Controls were carried in the noncarcinogenic hydrocarbons, phenanthrene choleic acid, and acenaphthene choleic acid, in desoxycholic acid, and with no hydrocarbons. Within the short period studied there was found a marked increase in the outgrowth of cells in cultures which received the carcinogen. Chromosome abnormalities were also reported in detail. From our own data during the first 2 or 3 days of culture no such stimulation as Creech reported was observed.

Mauer (7) studied the action of 3:4-benzpyrene, 1:2-benzanthracene, 1:2:5:6-dibenzanthracene, and 20-methylcholanthrene on chick fibroblasts taken from the pectoralis of 10- to 14-day chicks. These cells were cultivated in chicken plasma and chick embryo extract. In concentrations of 1/40,000 and 1/400,000, respectively, he found growth noticeably retarded in the carcinogen cultures at 1/400,000 in 20 days (7 to 8 passages), while in the 1/40,000 concentration the retardation was noted in from 4 to 5 passages. There was also marked degeneration from the carcinogen. Mauer noted many abnormal cell forms and abnormalities in cell cleavage. These findings coincide with our own. No attempt was apparently made in either Mauer's or Creech's work to control the action of light on the cells.

The results reported in this and the preceding article (5) have shown a definite initial retardative effect of methylcholanthrene on the growth of rat fibroblasts and on 3 different strains of intramuscular and subcutaneous mouse fibroblasts. The carcinogen also had a definitely injurious initial effect on these various cells. This effect was quite striking in a series of rat cells subjected to white light. It was less noticeable but definitely present in the 3 series of mouse cells not subjected to white light but handled in light of 480 mμ wavelength or longer. In spite of this initial retardative and toxic action these cultures continued to live in a culture medium saturated or nearly saturated with carcinogen and continued to grow under these conditions for extended periods of time, certainly for as long as 265 days. From all indications this growth would persumably have continued much longer or indefinitely.

That the greater success in the growth of these series 188, 189, and 191 of mouse cells was due solely to shielding them from white light is unlikely. Nor is it probable that this greater success was due to the use of mouse tissue instead of the rat tissues which were used in the earlier series. Our cultural conditions in the absence of carcinogen have grown either type of tissue with equal facility. Another factor which probably played a large rôle in the satisfactory growth of these cultures in methylcholanthrene is that while in the early series of rat-tissue cultures an attempt was made to transfer the cultures into fresh flasks about every 10 to 15 days, in these last 3 series of mouse tissues much longer transfer intervals were used. In view of the

severe retardative action of methylcholanthrene on the growth of the cultures the old transfer time of 10 to 15 days was almost certainly insufficient to allow the cultures to compensate fully for the loss of cells resulting from such transfer. The result was that at each such transfer the culture became progressively smaller. This is particularly well exemplified in series 176, set A (see ref. (*5*), page 378, chart 1). With series 188, 189, and 191 the experience previously acquired in handling strip cultures (*3*, *4*) allowed the use of such cultures and permitted them to be carried uninterruptedly in the same flasks for more than 100 days. This eliminated loss of cells resulting from frequent transfer. In view of the marked necrosis and the clouding and disintegration of the clot after about 90 days, more satisfactory results would probably be obtained if the cultures, while in methylcholanthrene, were transferred about every 60 days.

While the results obtained have shown that under the experimental conditions used methylcholanthrene had a definite initial retardative and injurious effect on the cultures, its later effect is not so easily interpreted. With reference to this later action there seems to be no question that the carcinogen definitely caused a retardation in the rate of increase in the diameters of the cultures subjected to it, and that this retardation persisted after the carcinogen was omitted from the cultures. The cell density, however, was far greater than the density of the controls. In view of this increase in cell density, the relative diameters of the control and carcinogen-treated cultures are no accurate criterion of their relative actual rates of growth. While, therefore, the first effect of the carcinogen on the culture was to cause retardation of growth, present data do not justify a conclusion as to whether this retardation continued or finally gave way to an acceleration of growth. This point must remain for further study. It should be emphasized, however, that there was a definite change in the character and type of growth.

The C_3H strain of mice used in this study has proven itself quite susceptible to the action of methylcholanthrene *in vivo*, as mice of this strain have shown tumors at the site of intramuscular or subcutaneous injection with great regularity (*1*, *8*). For instance, at about the same time series 188 was started in this laboratory, Dr. E. W. Wallace, in the course of some of his own work, injected 20 such mice, some intramuscularly, some subcutaneously. Each mouse received 2 mg. of methylcholanthrene in lard. All of these mice developed tumors at the injection sites in from 80 to 105 days.

Shear (*8*) found that methylcholanthrene crystals without lard exercised a carcinogenic action in a time comparable to that required when the carcinogen was injected in lard. We are probably justified in assuming that these crystals dissolve in the surrounding tissue fluids to create, directly around the crystals, an area or field of fluid

more or less saturated with the carcinogen. Under the conditions we used in tissue culture the medium was also essentially saturated, or very nearly saturated, with the carcinogen. If other conditions were as favorable *in vitro* as *in vivo* it would appear that in carrying a strain of cultures in the carcinogen for as long as 114 days, as in series 188, or 145 days, as in series 191, the cells of the cultures would have had ample time to assume changes of a malignant nature It is, therefore, significant that while the cells of series 191 55, exposed to carcinogen for 55 days, showed only very slight cohesion, the cells of series 188, exposed for 114 days, showed clearly defined changes, while the cells of series 191–146, exposed for 146 days, showed even more extreme changes In other words, the cells in the culture were undergoing definite changes at a time when *in vivo* the tumors would have been appearing. This observation, together with the fact that nearly all the changes observed in the cells *in vitro* were such as to make the cells more closely identical with the tumor cells induced by methylcholanthrene *in vivo*, seems to show that *in vitro* we have, to at least a certain extent, reproduced the *in vivo* action of the carcinogen.

At about 83 days after the carcinogen was omitted from series 188, each of 12 mice was injected with one culture of this series. While these mice were held far in excess of 120 days they never showed any signs of tumor. For the final recognition of the malignant cells, with our present inadequate criteria, it is necessary to rely on the production or nonproduction of tumor at the site of inoculation of the cells. The present results, therefore, furnish no conclusive evidence that the transformed cells resulting from the action of the carcinogen on these fibroblast cultures were malignant. However, so far only 12 mice have been injected and this number is too few for a conclusive result. Another complicating factor at present impossible to evaluate is that these injected cultures had been grown for more than one year in an entirely foreign culture medium (mouse cells in horse serum and chick embryo extract). What adaptation is necessary to reintroduce them to their normal *in vivo* medium we do not at present know. It should be emphasized, however, that although this final proof of the malignant nature of these cells treated in tissue culture with methylcholanthrene is lacking, in their morphology and in their cultural characteristics they have undergone changes which bring them recognizably closer to, and in many features identical with, the malignant cells which we have studied in tissue culture from tumors which arose in rats following subcutaneous methylcholanthrene injections. In other features, as, for instance, in the extreme cohesion of the cells, it is possible that the change *in vitro* has gone even further than the *in vivo* change. Further, all of these changes, while tending to produce a cell type simulating to a great

degree the *in vivo* induced malignant cells, have also certainly tended to remove the *in vitro* treated cells from the cell type of the normal fibroblast from which they arose.

In all of these studies great care was taken to try to keep the glassware free from any chance contamination with carcinogen. This was apparently successful up until about 45 days before the series was closed. At no time did the controls of series 188 ever show any evidence of carcinogen action. This series of cultures was always run entirely separate from the others in order to avoid any chance of cross contamination. At about 45 days before the series was closed, however, the controls of series 189 and 191 showed a trace of lateral cell adhesion. This was sufficiently pronounced to be easily recognizable At the same time it never even approximated the degree of that seen in any cultures that were deliberately treated with carcinogen. These controls of series 189 and 191 were being carried on in a group of cultures which was receiving high concentrations of carcinogen three times a week. As a result of this apparent contamination of the controls of series 189 and 191, a close examination of the whole tissue culture technique revealed a number of points which could have, and almost certainly did, let traces of carcinogen through into the controls of series 189 and 191 during the last 45 days of culture. There was far less possibility that traces of the carcinogen could have gotten through into the controls of series 188. If any carcinogen did get through into these controls, it was certainly insufficient to cause any recognizable change in the cells.

The cells which were treated with methylcholanthrene have shown a series of very clear and characteristic changes. These changes have been so fundamental as to alter not only the morphology of the cell but clearly to alter the morphology and the physiology of the cell and the culture. This has occurred in the tissues studied from 3 different mice, in cells from both subcutaneous and intramuscular origins. The alteration has persisted for a long time after the carcinogen was omitted from the cultures.

No control cultures of series 188 ever showed any action of the carcinogen and all cultures of the series were transferred separately from those cultures which received carcinogen. It therefore seems unlikely that a significant concentration of carcinogen could have crept into this series after the intentional addition of carcinogen was discontinued. Further, after the intentional addition of methylcholanthrene had been discontinued the cultures were transferred into fresh flasks from 12 to 15 times. They were soaked with from 1 to 2 cc. of saline more than 100 successive times for 1 hour each, and were soaked from 1 to 3 days each with more than 100 changes of 1 cc. each of fresh fluid culture medium. In spite of all this the changes produced by the carcinogen persisted for as long as the cultures were

carried, that is through 265 days after discontinuance of the carcinogen additions. Further, during the last 200 days of this time there seemed no further progressive or regressive change in these cultures.

The conclusion is obvious that during this time there could have persisted in these cultures only infinitesimal traces of carcinogen Until we know definitely more concerning the action of such extremely minute traces we cannot exclude the possibility, seemingly slight though it is, that these traces may have had some rôle in preserving the changes induced in the cells by the higher concentration. This possibility is also suggested by the work of Hollaender, Cole, and Brackett (*6*) of this Institute, who found a definite action of methylcholanthrene on yeast in a concentration as low as 10^{-8} or 10^{-9}. In the dark this effect was stimulative; in light the effect was injurious. Unless there was a persistence of activity of the methylcholanthrene in the extremely slight traces probably left in the treated cultures of series 188, it seems that the change which the carcinogen produced in the cells was a permanent one and one which continued relatively unaltered through subsequent generations of cells.

While some nuclear changes have been noted in these carcinogen-treated cells, studies on this point are as yet too incomplete to justify any conclusions. The outstanding changes observed have been those relating to cell form, shape, size, granulation, and, most remarkable of all, cell cohesion.

The increase of cell cohesion has been so striking as to justify some emphasis. This phenomenon, as well as the flattening of the cells and the rippling of the edges of the cells, strongly suggests fundamental changes, direct or secondary, in the cell membrane. That this is one site of localization of the carcinogen within the cell is suggested also by the fact that methylcholanthrene and other carcinogens are readily lipoid-soluble, while the cell membrane is rich in lipoids. Data available do not justify a conclusion as to whether the observed changes which seem to have resulted from a change in the cell membrane have any direct connection to the assumption of malignancy by the cell.

In the previous article (*5*) it was reported that particularly in the early life of cultures of series 186, less in the early life of cultures of series 188, there was a general tendency for the cells to migrate, as usual, radially from the center of the culture, but to arrange themselves circumferentially at the edges of the cultures. The question is raised as to whether the occurrence of this unusual orientation is not related to the various other observed changes apparently relating to surface membrane changes in the cells.

In this action of the carcinogen on the cells in culture, some cells, as stated, died. It appeared, however, that the cell type or types which finally dominated the cultures did not come from just one or two limited centers in each culture. It appeared rather that the

carcinogen was altering almost all, or all, of the cells in the culture, and that while some of the cells were unable to live, the majority of cells in the culture, or at least a great fraction of them, were altered and came through alive and in modified form.

It is of great interest that the action of this carcinogen on these cultures was apparently progressive with time. For instance, in series 191 at 55 days there was just a trace of cell adhesion, although this persisted after removal from the carcinogen. At 114 days in series 188 the characteristics of the cells were clearly and permanently altered in such a way as to show a progression of the increased cohesion of the cells seen at 55 days, while in series 191, held for 145 days in the carcinogen, this action of the carcinogen had resulted in even further alteration of the cells. This further alteration manifested itself in greater cohesion and more plate-like cell shapes. At no stage in the series of studies made have there been any suggestions seen of sudden alterations in the cultures. Rather it has appeared that after the initial stages of severe toxic action of the carcinogen, there followed gradual and progressive alterations in the cells of the cultures. In some instances these alterations resulted in such aberrant cell forms that they did not survive. In the main, however, there resulted cells radically and apparently permanently changed from the cells from which they arose and yet able to live and grow rapidly in the culture medium used

Another extremely interesting point is the fact that the longer the cells were subjected to the carcinogen the more closely they seemed to simulate epithelial cells in their manner of growth. Even at 114 days the similarity was quite striking, while at 145 days the cells were often far more easily classified as epithelium than are, for instance, the epithelial cells of the Walker mammary carcinoma 256. The significance of this morphological similarity of the carcinogen-treated fibroblast to the epithelial cell is not clear It is a point, however, which should not be lost sight of in the study of both carcinogenesis and of tissue organizers.

It is natural that in considering the radical changes induced in these cultures which were being treated with methylcholanthrene, the question arises as to whether or not the changes induced could have occurred from some uncontrolled agency other than methylcholanthrene. In order to rule out any possibility of this it can only be said that great care has been taken to try to eliminate such sources of error or uncertainty. The purity of the methylcholanthrene has already been discussed in the preceding article (*5*). The possibility of any contamination of the cultures with cells from tumor cultures or the possible inclusion of a tumor culture in the methylcholanthrene series through confusion of a culture label or through other error has been entirely eliminated through the fact that during this whole study on the action

of methylcholanthrene on the cultures of series 188, 189, and 191, no other cultures of any type, tumor or otherwise, have been handled in any way in the whole laboratory suite in which these studies were being carried on or by the operators concerned. Further, the actual handling of every culture has been done by only one operator (W. R. E.) while the preparation of all culture glassware and solution has been carried on completely within the one tissue culture suite. While of course it has been impossible to preclude the activity of some chemical or virus-like body which could have persisted in the laboratories from former handling of tumors, or which could have gotten in from other rooms, such speculation is entirely beyond the scope of this present study.

SUMMARY

1. The action of methylcholanthrene has been studied on 3 series (numbers 188, 189, and 191) of tissue cultures of fibroblasts from different adult C_3H strain mice. These 3 strains were subjected to 0.01 mg. of carcinogen per 1.0 cc. of culture fluid. The carcinogen was added to the culture fluid as a fine suspension.

2. The initial effect of the carcinogen was toxic and retardative for growth. Present data do not preclude the possibility that this was not later superseded by some stimulation of growth.

3. The cultures of series 188 were carried in the carcinogen for 115 days. The carcinogen was then omitted and the cells carried for 265 days in fresh culture medium. Even after the carcinogen was omitted and the medium had been changed more than 100 times, so that the residual carcinogen concentration was certainly extremely low, the radical changes observed in the cells persisted. These changes are described in detail.

4. The changes seen were in general confirmed by the second series, 189, but the cells of this series were not carried sufficiently long after addition of carcinogen had been discontinued to be considered more than confirmatory.

5. Series 191 was carried for 146 days in carcinogen, then in fresh culture medium for 104 days. Active traces of carcinogen remained in this series due to contamination of the culture glassware. The changes seen in this series were similar to those observed in the other series, but showed to a more exaggerated degree. They are described in detail.

6. In all cultures studied there was no sign of a sudden change in the culture from the action of the carcinogen. There seemed to be rather a gradual change which progressed with time.

7. Similarly, this change seemed to affect all, or at least the larger number, of the cells in the culture. There was no evidence that one

cell or one small local group of cells was transformed and that these overgrew the other cells in the culture.

8. With the exception of an epithelial-like sheet formation by the treated cells, all the changes observed tended to make the treated cells to a great degree like cells which the authors have studied in tumors which have arisen in rats from the injection of methylcholanthrene. The tendency has also been to make the treated cells strikingly different from the normal fibroblasts from which they arose. In regard to the epithelial-like sheet formation noted, while some of this has been seen in a strain of methylcholanthrene-induced tumor cells studied, the cohesion did not appear in as exaggerated a form as in some of the *in vitro* treated cultures. The suggestion is made that in this respect the cells may have gone even farther *in vitro* than they did under the action of the carcinogen *in vivo*.

9. Twelve mice were injected with carcinogen-treated cultures from series 188. The mice showed no tumors. The results are considered as inconclusive for reasons discussed.

10. It is emphasized that the chief changes observed in the cells seem to center around a change, either primary or secondary, in the cell membrane. The question is raised as to how crucial a change this is in the induction of malignancy in the carcinogen-treated cell.

ACKNOWLEDGMENT

In closing, the authors wish to acknowledge the technical assistance of Mr. E. L. Schilling in carrying on this work.

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OUR VERBAL PUBLIC HEALTH ACTIVITIES [1]

By Joseph W. Mountin, *Assistant Surgeon General, United States Public Health Service*

It seems to me highly desirable, since speech can so easily lead us into routine talkativeness, that we occasionally take time out to review our many word-of-mouth activities. Ever since public health work began expanding from merely regulating for health to include educating for health, it has year by year increased its teaching staff and added to the verbal content of its programs, until health instruction now ranks as one of our major activities. In fact, practically all our efforts have educational potentialities.

All public health workers are to some extent educators, but the public health nurse is the one on whom we rely chiefly for carrying out the biggest share of our program of instruction. These nurses on the whole spend more of their home-visiting time in teaching the subject of health than they do in actual nursing services. Our clinics, too, are centers of education, most of them having all the characteristics of an educational conference, with the nurse and physician as paid speakers on general or particular topics of health. Even those clinics organized for some specific service, such as immunization or venereal disease treatment, contribute to the information and experience of those who attend. The mothers' clubs run in connection with many prenatal clinics may differ in subject matter from the local Shakespearean Study Club but they have the same general objective. And so it goes. Even the sanitation officer, who once directed himself almost exclusively to law enforcement, has now become a lecturer on the more sanitary life. With all this instruction so prominent a factor in our public health endeavors, it behooves us to pause now and then to take stock of what it is we are saying. To this end the United States Public Health Service has undertaken a series of studies designed to evaluate educational effort, especially the spoken word, as used by nurses, sanitarians, and clinicians attached to health agencies.

This particular discussion has to do with what the nurses are saying. No less an authority than Dr. Haven Emerson places the responsibility for the success or failure of our educational program upon their shoulders. "The most effective permanent educational service for health," says Dr. Emerson, "is that delivered in person and by word of mouth by the public health nurse to the family in the home."[2]

This is the theory on which most health agencies are proceeding, and they are of course staking a great deal in time, money, and

[1] Presented at the Sixth Pacific Science Congress, Western Branch, American Public Health Association, Oakland, Calif., July 25, 1939. Part of a symposium on "The Spoken Word as a Method in Health Education."

[2] Emerson, Haven: Scope and form of local official health services with particular reference to the city of New York. N. Y. State J. of Med., 38: 796-802 (May 15, 1938).

expectations on these instructive home visits. When you consider that there are in our country about 20,000 nurses setting out daily on these home calls, and that most of them are required to do more teaching than actual nursing of the sick, the size of our investment in health education is obvious.

This being the situation, one of the most vital considerations in the whole public health movement is the effectiveness of the home instruction. Many administrators express the fear, with more or less definite instances in mind, that it is not adequate instruction. Many supervisors have witnessed home teaching which was not fitted to the situation. Many nurses will protest that it was an ill day when they had to change from nurse to teacher of health. The National Organization for Public Health Nursing in its Survey of Public Health Nursing [3] has set up a table of comparative ratings according to which the nurses reveal upon analysis less aptitude in their teaching activities than in their other duties.

It would be naive to complain simply because the nurses did not turn out to be superlative teachers. Why should they? What could be more logical, educationally speaking, than that a group who chose to be nurses should do better at nursing than at teaching? Convinced though we are that education is a highly necessary public health measure and that the nurses going into the homes have the finest sort of opportunity to carry on this education, we cannot lightly dismiss the fact that the nurse has been trained to minister to the sick. This is her chosen profession. Some nurses will tell you that they chose nursing in preference to teaching. At any rate, it is probably safe to assert that few of those women who decide to become nurses realize beforehand to what an extent public health nursing has become identified with education, or know that if they should join the staff of a health agency they will be asked to teach more often than to nurse.

This is not a circumstance that should persuade us to eliminate our instructive program, but it is a circumstance to be taken into account. We cannot change the fact that the nurse was educated for nursing rather than for teaching, but it is true that with her manifold contacts from home to home she is a logical public health educator. What we need to do is to study her instruction closely and try to revamp it, to build it up or pare it down, as may be necessary, to the end that it may be meaningful and useful and have nothing in it of settled routine or of talk that does not fit the case.

One direct method of studying the instruction given, and one which the Public Health Service has been using, is to take stenographic records of home calls and to supplement these verbatim accounts of

[3] Survey of Public Health Nursing. Katharine Tucker, general director, Hortense Hilbert, assistant director for the Survey. The Commonwealth Fund, Oxford University Press, New York, 1934. Page 206.

visits with the service records of the cases. We have done this for some 1,200 instructive home calls, and the resulting material has provided us with excellent data for discussion. These data are revealing upon analysis what we had desired to find—the reasons why the nurses do not succeed as well in their educational work as in their other activities.

The data give evidence, for one thing, of the fallacy in the current system of individualized instruction, of expecting the nurse to determine what should be done rather than to carry out the orders of physician or clinic. Public health nursing was designed originally to complement clinic service. Between sessions of the clinic the nurse would visit the home, in some instances to assist the family in carrying out the regimen prescribed at the clinic and in others to make field observations that might help the clinic physician to understand the circumstances surrounding the patient. But the emphasis has shifted from year to year, and the nurse working for an official health organization today is pretty much of a free agent, free to define her own job, to locate her clientele, and to decide what should be done under a wide variety of circumstances.

As the system works out, the nurse makes a relatively small proportion of her calls to carry out a particular assignment on the dictates of the physician or clinic. Bedside nursing visits are, of course, something else again; on such calls she is usually discharging certain duties in line with her nursing training, but these time-honored functions of the nurse do not come within this discussion.

Since the type of situation which the nurse selects for her calls is likely to be one in which medical advice figures, and since her training has been to care for persons under medical advice, it is not surprising to find her saying again and again: "See a physician." The value of such instruction is debatable, and when it is prolonged or repeated many times it is highly debatable. Almost every person who experiences untoward symptoms and possesses the money or the credit for a physician's advice will consult a doctor. If he hasn't the will to go, he probably has a sister or a mother or a neighbor to persuade him. If, however, he has neither the funds nor the credit, and if the community does not provide free facilities, then telling him that he should see a doctor amounts to a waste of time and of public funds. Yet the nurse frequently has no other practical advice to offer.

A similar stalemate results between the nurse and the household when the nurse has to say that she is not allowed to give some explanation in answer to their questions. Here, for example, is a tuberculosis call where the nurse must acknowledge the limitations of her teacher's permit and refer the family to the physician for an explanation of terms. The woman has asked regarding her husband, "Do you know if he is cured?"

NURSE The doctor at the clinic would have to tell you that

MRS. Chronic doesn't mean cured, does it? When I saw the letter, it says "chronic pulmonary tuberculosis." What does that mean?

NURSE. The doctor will have to interpret those things. I'm only a nurse and I'm not allowed to.

This is rather a paradoxical educational call, with the teacher falling back upon her position as a nurse in explanation of her inability to explain.

On the other hand, the nurse who is free to give a direct answer such as this, "Arrested means that the disease has been stopped, but it doesn't mean that he can stop being careful," is in a much more useful and much stronger position.

In the next quotation the nurse is explaining her calling to the patient:

"The visiting nurse takes care of you when you are sick. We come in to give you a lot of advice, and then tell you from time to time what to do in particular difficulties."

But what an infinitely better emissary of public health is the nurse who can say:

"Wouldn't you like me to give you a bath? You will feel so much better, and then we can discuss any health questions you may have."

Here is another illustration to show lack of substance in the spoken word as used on many of these calls:

NURSE (to a prenatal case). Did they tell you to take any care of them (the nipples) at the hospital?

MRS. No.

NURSE. They probably will the next time.

One could hardly blame this woman in the throes of maternity if she wondered why the nurse came into her home to bring up subjects and let them drop.

Another nurse on a postpartum call, using a homely analogy, gives the required instruction in a few brief sentences:

"Now you wouldn't want to drink out of a dirty cup, would you? Well, your nipple is the baby's cup. And that's the reason we're fussy about keeping the nipples clean."

The colloquial tone may not be suited to every call, but the clever nurse will adapt her instruction to the type of patient. The important point is to give the necessary information.

This next visit is to a woman who has been in bed for three days with a sore throat, unable to care for her month-old baby. The visit covers an interchange of some 89 remarks between patient and nurse, out of all of which the nurse may be credited with two efforts to meet the needs of the household. These two consist of a recommendation that a physician's advice be sought and a promise to send the visiting nurse to care for the baby and the mother. The sum total of the

nurse's activity here in the face of acute need is expressed in her last speech:

"Then send him (the husband) down to the home relief and they will send a doctor. I hope you feel better. I will send the visiting nurse in to take care of the baby, and don't forget to send your husband down to the home relief."

In case you object that the data seem critical, my defense must be to quote the first person who remarked, "The record speaks for itself." And in case you accuse me personally of being too critical, let me protest my sincere interest in the value of sound health education. My point is that the possible results are so great that it seems a shame to miss them by spreading the instructive work too thin.

It is not necessary that these results be missed. Certainly there are plenty of situations on which to work, there is much instruction to be conveyed and personal service to be rendered, and we have thousands of persons already hired and on the job. The problem is how to fuse these various elements. If time permitted I could detail a tuberculosis call on which the nurse through her recorded words can plainly be seen as the agent of the clinic carrying on its work in the field. The content of her visit is cut to fit the situation, but it is consistently held to the objective—to convey the information necessary to supplement the services of the clinic. A summary of the visit will show how instruction may be pointed to the end in view.

The tuberculous patient is in a late stage of the disease but has only recently gone to the clinic and had an examination. The nurse, addressing herself to the patient and his wife, instructs them in the use of tissues for his sputum, the disposal of the tissues, and the reasons for this care; shows them how to keep fresh air circulating through the room without causing a draft; explains the necessity of keeping the patient's dishes separate and of boiling them; advises fruit for his constipation; pictures a bare clean floor as unsafe for germs; tells the wife that for the protection of the household she must use a disinfectant after caring for the patient; emphasizes the necessity of isolation and shows how it may be accomplished in that situation; and gives the day and the time that the patient may attend the chest clinic.

It is quite apparent all through the transcript on this call that the nurse is keeping the purpose of her visit well in mind. She has come to the home to teach the family the importance of cleanliness, fresh air, isolation of the sick, precautions against the germ of tuberculosis, and not only to teach them but to show them how these things may be accomplished in their circumstances. Her instruction is brief and colloquial but connected and to the point. Her words are adjusted to the understanding of the family but without sacrifice of scientific accuracy, as shown by this paragraph:

"If he leaves something on the plate, if he leaves a piece of meat on the plate—we always say it's a sin to burn food but it isn't any sin to burn germs, hear? Because you're destroying germs when you burn them. You want to take this food he leaves on the plate and burn it; burn it up right away. Put it right on the fire; fire destroys germs. Boil his dishes first, and after you boil them, wash them with soap and water, and then keep them in a separate place. I guess you could keep them in here."

I am not suggesting the curtailment of the teaching functions of the nurse. As liaison officer between the physician or the clinic and the patient she has many tasks to perform which contribute to a well-rounded and smooth public health program. But in those cases where the choice of calls has been made on nothing sounder than routine visiting of a tuberculosis case every month or three months, or an infant hygiene case once a month, you are going to find much perfunctory and ineffective instruction. Our data show calls on which the nurse out of her store of book learning would proceed to instruct a mother in how to bring up her child, while the woman would listen politely and patiently but with an air of criticism for such a system of home visiting. That is to say, her remarks as they stand in the record would lead the reader to assume that her attitude was one of politeness, patience, and criticism.

On one such call the nurse asked concerning the sleeping hours, the food, the weight, the habits of the child, and so on, to all of which questions the mother gave courteous answers but of such a nature as to show very plainly her opinion that she could manage her own home situations. Finally she asked, "How do they decide what cases to look up?"

Another type of misspent call revealed by our data is that in which the nurse has not learned her lesson well enough to be teaching, or has not learned how to cut it to fit her client. If a patient stops a course of treatments because her arm swelled (as did a patient in our data) and is told by the nurse, "The doctor had to have the reactionary measure to know the physiological effect on your body," she is likely to be more confused than satisfied by the explanation.

But in the next quotation the nurse in discussing the Schick test is talking sense according to the comprehension of her patient:

"Then depending on your doctor's advice—it may be 6 weeks or it may be 6 months later—he should have a Schick test. It is a simple little skin test. The doctor injects a little medicine under the skin, and then in 2 or 3 days the doctor looks at that and he can tell if the diphtheria material is actually protecting the child against the disease. That is the reason for giving the Schick test. You know, to see if the child is actually protected."

An error common to almost every educational service is the reiteration of stock precepts. In health education the one regarding drinking milk is one of the commonest. Here is an example from our data:

NURSE. Is your appetite pretty good?
MRS. Sometimes.
NURSE. Are you drinking milk?
MRS. No, the doctor said not to. He wants to dry up my breasts.

This last example brings up the point I wish particularly to make. The weaknesses are the fault of the system more than they are the fault of the nurses. Poor administration is a cause of many errors. Lack of coordination between the clinic and the field nursing service is another. One cannot expect the nurse to be psychic about the clinic experiences of the patient. If the information is not on her record, and not otherwise provided her, she is bound to go into the homes asking unnecessary questions. Our data show her doing that again and again, perhaps urging the patient to go to the clinic when he has been there not 2 days since. Or she might be calling to discuss, and presumably to remedy, the nutritional disorder of one of the children, with apparently no clue given her as to whether the condition is one of faulty diet or of endocrine disturbance. Our data show one nurse saying, "Lie down in the morning and afternoon," and the patient contributing something more to the point, "The doctor told me from 2 to 4 was the best hours." And judging from the records, the two precepts of "eat more vegetables" and "drink more milk" seem to be considered pertinent advice regardless of the physical condition of the patient or the financial condition of the household.

The data clearly show us that much of the vital force of public health is misspent. Here are 20,000 nurses, a great potentiality for health education. But the possibilities of this corps will never be realized until there is a general tightening up in the system of distributing their services. A more accurate relationship between the physician and the patient or the clinic and the patient through the medium of the nurse will give a new value to the job.

In closing I would like to restate my approach. It seems to me that the time has come to evaluate the spoken word, and this I have tried to do out of the fullness of our data. This discussion is by no means offered as an analysis of bedside nursing, of clinic services, or of those liaison duties by which the nurse makes the clinic comprehensible to the patient and the patient amenable to the clinic. Such services are implicit in it, of course, because in greater or lesser degree their results are bound up with the achievements of health education.

In the various analyses of our data on the content of health education, the results of which will be published as they are completed, one idea becomes increasingly clear, and that is that individualized instruction to be good must be highly specialized. It must be teaching suited to the person, his circumstances, and his symptoms. It implies an examination by one competent to make it and to give the necessary recommendations. Individualized instruction is expensive. In say-

ing that I do not decry its necessity, but only protest against carrying retail to the patient that general instruction which could be sent wholesale.

The theory behind home visiting is that the nurse working in the family's home surroundings may best adapt her instruction to their requirements. Her practice on many such calls, however, might be described by that homely phrase "to give a lick and a promise." And even that "lick and promise" may not be applied with the discrimination that it might be.

Far from advocating a paring down of the services now rendered, I merely express the opinion that some weeding out of this loose application of instruction is necessary to assure the stability and orderly growth of a technique which can have definite value in public health practice.

TESTS FOR COMPLETENESS OF BIRTH REGISTRATION

The degree of completeness of birth registration in the United States and in the respective States is important to students of population, for it affects the birth rates, infant and maternal mortality rates, the computation of true rates of increase and of life tables according to certain formulas, the relative standing of various States, racial comparisons, and other related vital and demographic statistics.

In 1934, Whelpton [1] estimated the completeness of birth registration for the several States for the period April 1, 1929, to April 1, 1930, using the Foudray index, and found that the registration of white births was deficient by over 10 percent in 18 to 20 States and of Negro births by a similar percentage in 13 States. He also found that the differences in the percentage of births registered were influenced by the length of time a particular State had been in the birth registration area of the Bureau of the Census, the original birth registration States apparently recording from 97.4 to 98.1 percent of white births and from 97 to 99.2 percent of Negro births, according to the method employed in applying the Foudray index. In contrast, the 12 States admitted to the birth registration area during the period 1926–29 registered only about 85 percent of the white births and about 77 percent of the Negro births during the same period, as calculated by the same index.

A recent report issued by the Bureau of the Census [2] summarizes the findings of birth-registration test surveys conducted in Georgia and Maryland and compares the results of different methods of testing. In Georgia, 490,000 conventional birth-registration test mailing cards,

[1] Whelpton, P K: The completeness of birth registration in the United States J. Am. Stat Assoc, 29: 125–136 (June 1934).

[2] Vital Statistics, Special Reports, vol. 7, No. 60, pp. 679–695. Birth registration tests by several methods in Georgia and Maryland. By A. W. Hedrich, John Collinson, and F. D Rhoads.

requesting a report of any birth occurring during the preceding 12 months, were distributed by carriers from local post offices. Some time later enumerators made a house-to-house check survey. In Maryland, 23,000 mailing test cards were used and the results were checked later by enumerators as well as against the reports of a preschool census of the families covered by the cards.

The surveys were conducted in cooperation with the State departments of health and were designed principally to answer the following basic questions:

1. Among which population groups is birth registration least complete?

2. How representative or dependable, for purposes of measuring completeness of birth registration, are lists of births obtained from (*a*) the conventional test card used by the Bureau of the Census and (*b*) the census of preschool children.

All birth records obtained in the surveys were carefully checked against the birth register.

The relative completeness of birth registration as found in these surveys and shown in tables 1 and 2 brings out some interesting and contrasting percentages for various population groups.

In these tables the ratios of percentages in the last column present a direct comparison of the differences in the completeness of registration found in the different population groups. The large differences shown in table 1 between cases attended by a physician and those without professional attendance, for both white and colored, might be expected. The report states that the smaller differences found between other groups are also statistically significant. For example, the difference indicated between the large-city and rural Negro groups would be expected to occur by chance only once in some millions of trials, while the smaller difference between the health-officer and non-health-officer counties would occur by chance in less than 1 out of 100 trials.

The differences between the groups were much less pronounced in Maryland, and in some instances were in opposite directions, though it is stated that the test cards as distributed in Georgia probably tended to select the higher social groups, thereby yielding a calculated completeness of reporting which was somewhat too high.

Some interesting points were brought out regarding the faults found in the methods used. Two principal factors were involved in the selection of families by the test-card distribution. One was the uneven distribution of the cards by the mail carriers, who were frequently found to have left the cards only where they had other mail to deliver. Since the poorer and uneducated families receive less mail than the prosperous and well educated, there was obviously a selection in favor of the latter class. The other selective factor was that the better

educated families, with more complete birth registration, tended to mail back their cards more promptly than did the poorer, and less completely registered, families.

TABLE 1.—*Completeness of birth reporting in contrasting population groups, Georgia (26 counties) 1934*

Population groups contrasted		Births enumerated		Births found registered		Percent registered		Ratio of percentages
A. Superior registration	B. Inferior registration	A	B	A	B	A	B	A/B
Large city,[1] white	Rural,[2] white	1,572	585	1,512	479	96.2	81.9	1.17
Large city,[1] Negro	Rural,[2] Negro	1,262	329	1,187	232	94.1	70.5	1.33
Large city,[1] total	Rural,[2] total	2,834	914	2,699	711	95.2	77.8	1.22
Hospitalized	Nonhospitalized	1,917	4,888	1,879	4,034	98.0	82.5	1.19
Attended by physician,[3] white.	No professional attendance, white.	2,419	31	2,046	19	84.6	61.3	1.38
Attended by physician,[3] Negro.	No professional attendance, Negro.	712	26	599	13	84.1	50.0	1.68
Attended by midwife, white.	Attended by midwife, Negro.	288	1,372	242	1,075	84.0	78.3	1.07
Lived to 1 year of age	Died under 1 year of age	6,610	195	5,763	149	87.2	76.4	1.14
Educated	Uneducated	697	838	622	663	89.2	79.1	1.13
Well-to-do	Poor	186	2,040	173	1,686	93.0	82.6	1.13
White	Negro	4,040	2,765	3,586	2,326	88.8	84.1	1.05
Health-officer counties	Nonhealth-officer counties.	893	2,211	743	1,745	83.2	78.9	1.05

[1] *Large city* includes 5 cities over 25,000 population: Atlanta, Savannah, Macon, Augusta, and Columbus.
[2] *Rural* means "strictly rural."
[3] Nonhospital births only.

TABLE 2.—*Completeness of birth reporting in contrasting population groups, Somerset County, Md., 1936*

Population groups contrasted		Births enumerated		Births found registered		Percent registered		Ratio of percentages
A	B	A	B	A	B	A	B	A/B
Urban [1]	Rural	124	259	117	241	94.3	93.1	1.01
Hospitalized	Nonhospitalized	41	342	40	318	97.6	93.0	1.05
Lived to 1 year	Died under 1 year	350	30	325	30	92.9	100.0	.93
Educated	Uneducated	122	101	113	97	92.6	96.0	.96
Well-to-do	Poor	25	241	24	227	96.0	94.2	1.02
White	Negro	208	173	192	164	92.3	94.8	.97

[1] Crisfield, population 3,850.

An analysis of these birth-registration test surveys apparently indicates that, at least in the States surveyed, and probably in other States, the problem of incomplete birth registration is concerned chiefly with the less privileged families, and that the test-card method may tend to miss some of these families unless special precautions are taken.

From various studies that have been made it is evident that birth registration is much more complete in some States than in others, and that adjustments for these variations should be made in studies dealing with the numbers of births, birth rates, infant mortality, life tables, and other population statistics. The 1940 census, which will provide data for determining coefficients of correction in birth rates,

as well as for other studies of intercensal population problems, will be awaited with interest by vital statisticians and students of demography.

DEATHS DURING WEEK ENDED FEBRUARY 3, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Feb 3, 1940	Corresponding week, 1939
Data from 88 large cities of the United States.		
Total deaths	10,101	9,475
Average for 3 prior years	9,705	
Total deaths, first 5 weeks of year	48,140	45,837
Deaths under 1 year of age	572	555
Average for 3 prior years	581	
Deaths under 1 year of age, first 5 weeks of year	2,761	2,690
Data from industrial insurance companies:		
Policies in force	66,327,780	68,258,073
Number of death claims	13,817	13,336
Death claims per 1,000 policies in force, annual rate	10.9	10.2
Death claims per 1,000 policies, first 5 weeks of year, annual rate	10.4	10.1

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 17, 1940

Summary

The influenza situation changed very little during the week ended February 17 as compared with the preceding week, with the highest incidence still definitely prevailing in the South Atlantic and South Central groups of States. A total of 16,548 cases was reported for the current week as compared with 16,583 for the week ended February 10, and with 17,641 for the week of February 3. The number of cases reported for the corresponding median week of the 5-year period 1935–39 is 8,591, and the 5-year average is 9,932. The Mountain and Pacific States show a decline in the number of cases for the current week, while some increase is recorded for the East North Central group.

For the first 7 weeks of 1940 a total of 98,728 cases of influenza has been reported, of which 83,593, or 85 percent occurred, in the South Atlantic and South Central States, which have 32 percent of the total population.

The highest number of cases reported to date was for the week ended February 3, and the largest number of deaths in 88 large cities, as reported to the Bureau of the Census, occurred during the same week, with 10,161 deaths, as compared with 10,049 for the week of February 10, and with 9,751 for the week ended February 17.

The incidence of the other 8 communicable diseases included in the following table remained low, all of which were much below the 5-year median expectancy, except poliomyelitis, for which 27 cases were reported for the current week as compared with a 5-year median of 25.

One case of anthrax was reported in Utah.

Telegraphic morbidity reports from State health officers for the week ended February 17, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Feb. 17, 1940	Feb. 18, 1939		Feb. 17, 1940	Feb. 18, 1939		Feb. 17, 1940	Feb. 18, 1939		Feb. 17, 1940	Feb. 18, 1939	
NEW ENG.												
Maine	3	6	1	7	8	9	217	15	87	0	0	0
New Hampshire	0	0	0				84	7	20	0	0	0
Vermont	0	0	0				2	7	7	0	0	0
Massachusetts	4	2	8				320	1,136	706	0	2	2
Rhode Island	0	1	1				96	14	17	0	1	0
Connecticut	0	0	1	3	22	21	108	593	568	0	0	0
MID. ATL.												
New York	26	23	37	[1] 43	[1] 137	[1] 69	274	1,048	1,290	4	4	9
New Jersey	12	14	11	30	99	23	49	27	407	0	1	3
Pennsylvania	35	39	46				74	153	640	20	5	5
E. NO. CEN.												
Ohio	22	41	41	202		95	46	26	216	1	3	9
Indiana	17	24	35	596	363	113	5	10	12	0	1	3
Illinois	23	28	38	128	955	67	18	31	31	0	0	8
Michigan [2]	6	12	10	31	39	12	275	424	424	2	0	4
Wisconsin	4	1	1	112	56	70	165	1,343	1,343	0	0	1
W. NO. CEN.												
Minnesota	3	5	2	2	3	3	366	1,236	195	1	0	1
Iowa	3	11	8	86	27	27	174	177	100	0	1	2
Missouri	8	10	12	59	137	308	15	11	16	1	3	3
North Dakota	0	2	2	20	14	14	3	148	15	0	0	0
South Dakota	0	2	1	6	3		2	322	3	0	0	0
Nebraska	5	6	6				95	62	16	0	0	1
Kansas	11	13	8	32	9	40	479	26	26	5	0	1
SO. ATL.												
Delaware	1	2	1				1	0	34	0	0	0
Maryland [2]	3	2	11	131	182	113	2	1,174	214	3	2	2
Dist. of Col.	5	8	7	19	18	3	2	10	7	0	1	2
Virginia [3]	19	19	17	2,395	1,338		33	176	188	4	1	8
West Virginia [3]	6	7	12	954	33	88	6	21	21	0	4	4
North Carolina	17	29	23	121	71	93	109	866	653	0	0	2
South Carolina [3]	11	17	4	1,041	972	972	6	30	30	1	2	1
Georgia [3]	7	11	11	486	139	481	405	161	0	1	2	2
Florida [3]	5	4	5	50	1	18	55	53	48	0	0	0
E. SO. CEN.												
Kentucky	9	13	14	136	478	90	42	106	106	2	8	13
Tennessee [3]	8	10	10	677	63	245	108	119	67	4	1	6
Alabama [3]	7	14	11	933	160	686	148	284	284	1	6	5
Mississippi [2]	6	6	5							0	4	2
W. SO. CEN.												
Arkansas	5	10	9	1,555	113	113	16	107	22	2	1	2
Louisiana [3]	6	15	15	342	11	21	3	145	40	2	0	1
Oklahoma	11	8	8	655	129	217	3	94	34	0	2	5
Texas [3]	41	51	56	4,513	983	981	304	228	202	3	6	6
MOUNTAIN												
Montana	3	1	1	4	35	35	38	306	56	0	0	0
Idaho	0	5	1			6	26	36	29	0	0	0
Wyoming	1	0	0	5			34	17	3	0	0	0
Colorado	13	16	10	27	125		34	91	91	3	0	0
New Mexico	1	1	6	4	1	8	5	42	42	0	0	0
Arizona	0	6	1	259	82	151	20	21	21	4	0	0
Utah [2]	0	0	0	10	16		203	81	11	0	0	0
PACIFIC												
Washington	2	0	1	3	3	3	664	271	174	1	1	1
Oregon	8	2	2	70	42	71	351	27	27	0	0	0
California	20	32	30	771	28	306	374	2,534	530	2	1	8
Total	397	524	538	16,548	6,895	8,591	5,859	13,876	13,876	67	63	134
7 weeks	3,025	4,042	4,594	98,728	27,772	27,772	31,841	75,068	75,068	265	386	673

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 17, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Feb. 17, 1940	Feb. 18, 1939		Feb. 17, 1940	Feb. 18, 1939		Feb. 17, 1940	Feb. 18, 1939		Feb. 17, 1940	Feb. 18, 1939	
NEW ENGLAND												
Maine	0	0	0	26	28	23	0	0	0	0	1	0
New Hampshire	0	0	0	4	4	8	0	0	0	0	0	0
Vermont	0	0	0	12	12	11	0	0	0	0	0	0
Massachusetts	0	0	0	146	222	232	0	0	0	1	3	2
Rhode Island	0	0	0	11	17	19	0	0	0	0	0	0
Connecticut	0	0	0	92	92	92	0	0	0	1	1	0
MID. ATL.												
New York	1	0	0	750	648	771	0	0	0	4	6	6
New Jersey	0	1	0	466	166	166	0	0	0	0	0	1
Pennsylvania	2	0	0	370	524	552	0	0	0	5	6	6
E. NO. CEN.												
Ohio	0	0	1	419	493	473	0	41	1	1	5	2
Indiana	0	2	0	286	231	231	0	80	3	8	5	2
Illinois	1	1	1	524	510	668	0	21	21	3	3	5
Michigan [2]	0	0	1	290	538	538	0	20	3	2	4	2
Wisconsin	3	0	0	170	284	320	10	5	5	0	0	1
W. NO. CEN.												
Minnesota	1	0	0	109	109	151	7	8	8	1	0	0
Iowa	1	0	0	59	142	142	6	35	29	1	1	1
Missouri	0	0	0	80	146	170	9	6	6	0	0	2
North Dakota	0	0	0	21	9	59	0	1	1	2	1	1
South Dakota	0	0	0	30	15	15	3	8	3	0	0	0
Nebraska	0	0	0	18	90	90	0	6	16	0	0	0
Kansas	0	0	0	88	170	201	0	5	13	1	4	1
SO. ATL.												
Delaware	0	0	0	25	0	11	0	0	0	0	0	0
Maryland [3]	0	0	0	65	33	56	0	0	0	0	1	1
Dist. of Col	0	0	0	24	20	21	0	0	0	1	1	1
Virginia [3]	0	0	0	27	45	43	0	0	0	2	6	6
West Virginia [3]	1	2	1	78	75	57	0	0	0	2	8	3
North Carolina	0	1	0	55	77	42	0	0	0	0	5	1
South Carolina [3]	0	2	0	8	6	4	0	0	0	1	6	1
Georgia [3]	0	1	0	18	19	19	0	1	0	2	4	3
Florida [3]	0	0	0	20	11	11	0	1	0	2	1	1
E. SO. CEN.												
Kentucky	2	2	2	50	104	54	1	14	0	1	6	6
Tennessee [3]	2	0	0	103	47	43	0	1	0	0	3	1
Alabama [3]	1	0	0	14	20	19	0	0	0	0	4	3
Mississippi [3]	0	0	0	6	4	8	3	0	1	1	1	8
W. SO. CEN.												
Arkansas	1	0	0	7	6	14	2	5	4	1	4	2
Louisiana [3]	1	1	1	6	12	12	0	0	0	3	16	16
Oklahoma	1	0	0	23	52	35	1	16	3	4	1	3
Texas [3]	4	0	0	53	116	108	1	46	19	7	9	10
MOUNTAIN												
Montana	0	0	0	24	32	32	0	1	6	1	0	0
Idaho	0	0	1	12	7	22	0	4	4	2	1	1
Wyoming	0	0	0	9	7	11	1	0	0	0	0	0
Colorado	0	0	0	55	37	37	9	18	8	0	0	0
New Mexico	0	0	0	21	19	19	0	1	1	2	0	3
Arizona	0	0	0	4	9	24	1	0	0	0	0	0
Utah [2]	2	0	0	28	33	77	1	0	0	1	0	0
PACIFIC												
Washington	0	0	1	58	56	56	0	1	17	0	0	0
Oregon	0	0	0	18	55	55	0	3	3	1	0	1
California	3	0	2	162	166	252	0	17	9	3	3	3
Total	27	13	25	4,903	5,518	7,067	55	365	299	67	115	115
7 weeks	230	115	150	30,854	37,320	43,602	508	2,750	2,081	543	776	803

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 17, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued.

Division and State	Whooping cough, Week ended Feb. 17, 1940	Whooping cough, Week ended Feb. 18, 1939
NEW ENG.		
Maine	34	39
New Hampshire	3	0
Vermont	41	39
Massachusetts	119	325
Rhode Island	3	63
Connecticut	45	91
MID. ATL.		
New York	418	552
New Jersey	120	430
Pennsylvania	377	394
E. NO. CEN.		
Ohio	224	202
Indiana	34	33
Illinois	75	274
Michigan [2]	145	238
Wisconsin	137	317
W. NO. CEN.		
Minnesota	20	25
Iowa	12	14
Missouri	9	36
North Dakota	3	7
South Dakota	2	5
Nebraska	5	8
Kansas	43	10
SO. ATL.		
Delaware	11	1
Maryland [2]	116	33
Dist. of Col.	18	21
Virginia [3]	47	73
West Virginia [2]	21	30
North Carolina	84	251
SO. ATL.—continued		
South Carolina [3]	15	82
Georgia [3]	27	33
Florida [3]	7	21
E. SO. CEN.		
Kentucky	48	27
Tennessee [3]	37	51
Alabama [3]	33	25
Mississippi [2]		
W. SO. CEN.		
Arkansas	5	19
Louisiana [3]	11	14
Oklahoma	0	1
Texas [3]	136	155
MOUNTAIN		
Montana	4	4
Idaho	0	1
Wyoming	8	0
Colorado	12	51
New Mexico	60	23
Arizona	12	5
Utah [2]	79	28
PACIFIC		
Washington	26	13
Oregon	26	5
California	153	77
Total	2,865	4,149
7 weeks	19,585	30,160

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Feb. 17, 1940, 18 cases as follows: Virginia, 1; South Carolina, 2; Georgia, 2; lorida, 3; Tennessee, 1; Alabama, 3; Louisiana, 1; Texas, 5.

WEEKLY REPORTS FROM CITIES

City reports for week ended February 3, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	188	1,332	151	4,030	969	1,965	39	383	18	1,161	--------
Current week [1]	124	969	111	1,157	708	1,429	8	364	21	734	--------
Maine:											
Portland	0	------	0	21	0	2	0	0	0	9	23
New Hampshire:											
Concord	0	------	0	0	1	1	0	0	0	0	8
Manchester	0	------	0	0	1	0	0	0	0	0	7
Nashua	0	------	0	9	0	0	0	0	0	1	5
Vermont:											
Barre	0	------	0	0	0	0	0	1	0	0	3
Burlington	0	------	0	0	0	0	0	0	0	5	10
Rutland	0	------	0	0	0	0	0	0	0	0	3
Massachusetts:											
Boston	0	------	0	19	20	25	0	7	0	33	237
Fall River	0	------	0	11	1	0	0	0	0	1	28
Springfield	0	------	0	0	2	4	0	0	0	0	34
Worchester	1	------	0	2	12	2	0	2	0	3	63
Rhode Island:											
Pawtucket	0	------	0	2	0	1	0	0	0	0	11
Providence	0	1	1	116	5	10	0	4	0	11	70
Connecticut:											
Bridgeport	0	3	1	0	3	2	0	1	0	0	36
Hartford	0	------	0	1	3	2	0	3	9	8	50
New Haven	0	1	0	0	1	2	0	1	0	3	37
New York:											
Buffalo	0	------	1	0	18	15	0	8	0	3	172
New York	26	19	2	41	65	831	0	75	0	87	1,568
Rochester	0	2	0	1	4	14	0	1	0	9	76
Syracuse	0	------	0	0	4	5	0	1	0	8	52
New Jersey:											
Camden	0	------	2	0	8	8	0	0	0	1	30
Newark	0	------	0	7	5	20	0	8	0	13	126
Trenton	0	1	0	2	2	3	0	7	0	0	48
Pennsylvania:											
Philadelphia	4	47	15	10	43	71	0	25	0	48	639
Pittsburgh	3	18	6	0	29	34	0	5	0	6	216
Reading	0	------	0	8	4	0	0	0	0	10	29
Scranton	0	------	--------	1	-------	7	0	-------	0	0	--------
Ohio:											
Cincinnati	1	1	0	0	9	13	0	4	0	24	157
Cleveland	2	51	0	4	14	30	0	13	0	30	137
Columbus	1	2	2	0	6	5	0	2	0	2	113
Toledo	0	2	0	1	2	12	0	5	0	9	94
Indiana:											
Anderson	0	------	0	0	1	0	0	0	0	6	14
Fort Wayne	1	------	0	0	4	1	0	0	0	0	26
Indianapolis	5	------	0	0	17	26	0	8	0	3	110
Muncie	1	------	1	0	5	4	2	1	0	0	21
South Bend	0	------	0	0	1	1	0	0	0	0	11
Terre Haute	0	------	0	0	6	2	0	1	0	1	20
Illinois:											
Chicago	7	38	5	23	45	344	0	30	0	41	810
Elgin	0	------	0	1	1	7	0	0	0	0	18
Moline	0	------	0	0	0	0	0	0	0	0	11
Springfield	0	8	2	0	6	13	0	1	2	8	87
Michigan:											
Detroit	11	------	0	8	21	68	0	12	0	25	328
Flint	0	------	0	0	5	7	0	0	0	5	32
Grand Rapids	0	1	1	1	2	12	0	0	0	4	44
Wisconsin:											
Kenosha	0	------	0	0	0	2	0	0	0	0	12
Madison	0	------	0	0	2	2	0	0	0	4	17
Milwaukee	0	1	1	1	5	42	0	8	0	3	107
Racine	0	------	0	1	0	3	0	0	0	7	21
Superior	0	------	0	3	1	2	0	0	0	0	15

[1] Figures for Little Rock and Boise estimated; reports not received.

City reports for week ended February 3, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Minnesota:											
Duluth	0	-	0	284	3	2	0	1	0	2	33
Minneapolis	0	-	1	5	3	23	0	4	0	6	104
St. Paul	0	1	1	1	4	11	0	0	0	21	71
Iowa:											
Davenport	0	-	-	0	-	0	0	-	0	0	-
Des Moines	1	-	0	2	0	9	0	0	0	0	31
Sioux City	0	-	-	0	-	8	0	-	0	0	-
Waterloo	1	-	-	0	-	2	0	-	0	0	-
Missouri:											
Kansas City	2	8	0	0	6	24	0	5	0	8	115
St. Joseph	0	-	1	0	1	2	0	0	0	0	24
St. Louis	4	4	2	2	18	22	2	8	2	1	207
North Dakota:											
Fargo	0	-	0	0	0	1	0	0	0	0	4
Grand Forks	0	-	-	0	-	1	0	-	0	1	-
Minot	0	-	0	0	0	1	0	0	0	0	5
South Dakota:											
Aberdeen	0	-	-	0	-	0	0	-	0	1	-
Nebraska:											
Lincoln	0	-	-	0	-	8	0	-	0	0	-
Omaha	0	-	0	2	4	2	0	0	0	3	58
Kansas:											
Lawrence	1	12	-	0	1	0	0	0	0	0	6
Topeka	0	1	1	1	4	8	0	0	0	0	22
Wichita	0	1	0	230	3	3	0	0	0	2	31
Delaware:											
Wilmington	0	-	0	0	4	3	0	0	0	2	26
Maryland:											
Baltimore	4	56	4	8	27	20	0	12	0	107	289
Cumberland	0	3	0	0	1	0	0	0	1	0	14
Frederick	0	-	0	0	0	1	0	0	0	0	1
Dist. of Col.:											
Washington	8	24	5	0	45	23	0	13	0	9	276
Virginia:											
Lynchburg	0	-	0	0	5	3	0	1	0	7	19
Richmond	0	-	1	0	0	7	0	1	1	0	81
Roanoke	0	-	0	0	5	0	0	2	0	2	25
West Virginia:											
Charleston	1	-	0	0	0	0	0	0	0	0	21
Huntington	0	-	-	0	-	1	0	-	0	0	-
Wheeling	0	-	0	0	0	2	0	0	0	0	16
North Carolina:											
Gastonia	1	-	-	0	-	1	0	-	0	2	-
Raleigh	0	-	0	0	7	0	0	1	0	0	32
Wilmington	0	-	0	0	0	0	0	0	0	0	18
Winston-Salem	1	2	0	0	1	3	0	0	0	0	19
South Carolina:											
Charleston	0	157	1	0	4	0	0	0	0	0	39
Florence	0	2	1	0	2	0	0	0	0	0	13
Greenville	0	-	0	0	2	0	0	0	0	0	14
Georgia:											
Atlanta	0	115	8	34	17	3	0	6	0	0	125
Brunswick	0	-	0	1	1	0	0	0	0	0	5
Savannah	0	50	4	0	4	4	0	1	0	0	43
Florida:											
Miami	0	8	2	1	2	2	0	0	0	3	60
Tampa	2	18	2	11	6	1	0	0	0	2	53
Kentucky:											
Ashland	1	7	0	0	1	1	0	0	0	6	6
Covington	0	1	0	0	0	2	0	3	0	0	18
Lexington	0	-	0	0	1	2	0	2	0	3	25
Louisville	0	34	1	1	13	15	0	1	0	31	85
Tennessee:											
Knoxville	0	5	3	0	5	13	0	1	0	0	50
Memphis	0	27	4	2	8	22	0	6	0	8	114
Nashville	0	-	6	20	12	8	0	6	0	2	80
Alabama:											
Birmingham	0	33	2	0	9	8	0	4	0	0	115
Mobile	1	-	4	1	0	1	0	2	0	0	37
Montgomery	1	9	-	6	-	0	0	-	0	0	-
Arkansas:											
Fort Smith	0	27	-	0	-	0	0	-	0	0	-
Little Rock	-	-	-	-	-	-	-	-	-	-	-
Louisiana:											
Lake Charles	0	-	0	0	0	0	0	0	0	0	2
New Orleans	2	57	5	0	27	4	0	12	2	19	257
Shreveport	1	-	1	0	11	0	0	3	2	0	59

City reports for week ended February 3, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oklahoma:											
Oklahoma City	0	------	0	0	5	2	0	1	0	0	62
Tulsa	3	------	------	0	------	10	0	------	0	2	------
Texas:											
Dallas	21	12	2	9	8	18	0	4	0	20	77
Fort Worth	0	------	0	0	2	1	0	1	0	14	48
Galveston	1	------	0	0	1	2	0	2	0	0	22
Houston	3	5	1	0	19	4	0	6	0	1	115
San Antonio	2	5	5	35	18	0	0	8	1	0	115
Montana:											
Billings	0	------	0	0	0	1	0	0	0	0	9
Great Falls	0	------	0	0	0	2	0	0	0	0	6
Helena	0	------	0	2	0	0	0	0	0	0	2
Missoula	0	------	0	24	1	1	0	0	0	0	6
Idaho:											
Boise	------	------	------	------	------	------	------	------	------	------	------
Colorado:											
Denver	2	------	2	5	7	7	0	2	0	6	86
Pueblo	1	------	0	0	0	0	0	1	0	1	7
New Mexico:											
Albuquerque	0	------	0	0	0	4	0	2	0	2	13
Utah:											
Salt Lake City	1	------	1	15	1	13	1	1	1	85	37
Washington:											
Seattle	0	------	2	119	12	7	0	6	0	0	109
Spokane	0	------	2	1	2	1	0	0	0	5	33
Tacoma	0	------	0	64	5	3	0	1	0	0	39
Oregon:											
Portland	2	26	2	49	11	6	0	1	0	9	104
Salem	0	------	------	17	------	0	0	------	0	0	------
California:											
Los Angeles	3	194	2	10	5	36	0	17	0	9	374
Sacramento	0	3	2	1	3	0	0	3	0	0	39
San Francisco	1	3	0	0	8	10	0	6	0	10	191

State and city	Meningococcus meningitis		Poliomyelitis cases	State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Rhode Island:				Maryland:			
Providence	0	0	1	Baltimore	2	0	0
New York:				Washington:			
New York	3	0	0	Seattle	10	0	0
Michigan:				Spokane	0	1	0
Detroit	0	0	1	California:			
Minnesota:				Los Angeles	0	0	1
Minneapolis	0	0	1	San Francisco	1	0	0

Encephalitis, epidemic or lethargic.—Cases: New York, 1.
Pellagra.—Cases: Boston, 1; Philadelphia, 1; Savannah, 2; New Orleans, 1; Dallas, 1.
Typhus fever.—Cases: New York, 1.

FOREIGN REPORTS

GREAT BRITAIN

England and Wales—Infectious diseases—13 weeks ended September 30, 1939.—During the 13 weeks ended September 30, 1939, cases of certain infectious diseases were reported in England and Wales as follows:

Disease	Cases	Disease	Cases
Diphtheria	10,524	Puerperal pyrexia	2,347
Dysentery	402	Scarlet fever	18,366
Ophthalmia neonatorum	1,140	Typhoid fever	631
Pneumonia	4,681		

England and Wales—Vital statistics—Third quarter 1939.—During the third quarter ended September 30, 1939, 161,201 live births and 103,170 deaths were registered in England and Wales. The following statistics were taken from the Quarterly Return of Births, Deaths, and Marriages, issued by the Registrar General, and are provisional:

Birth and death rates in England and Wales, quarter ended September 30, 1939

Annual rates per 1,000 population:	
Live births	15.5
Stillbirths	.57
Deaths, all causes	9.9
Deaths under 1 year of age	[1] 39
Deaths from:	
Diarrhea and enteritis (under 2 years of age)	[1] 4.6
Annual rates per 1,000 population—Continued:	
Deaths from—Continued:	
Diphtheria	.04
Influenza	.03
Measles	.01
Whooping cough	.02

[1] Per 1,000 live births.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following table must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended—			
				6	13	20	27
ASIA							
Afghanistan	D	578					
Ceylon: Batticaloa	C	7					
China	C	2,705					
Canton	C	9					
Hong Kong	C	684	4				
Shanghai	C	427					
Tientsin	C	84					
India	C	114,943					
Bassein	C	14					
Calcutta	C	3,803	124	32	14	31	22
Madras	C	6					1
Negapatam	C	2					
Rangoon	C	17	1		1	1	4
India (French)	C	91					
India (Portuguese)	C	17					
Indochina (French)	C	1					
Iran	C	435					
Iraq: Basra	C	[1] 1					
Japan: Osaka	C	[2] 1					
Thailand	C	25					
Bangkok	C	7					

PLAGUE

[C indicates cases, D, deaths]

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended—			
				6	13	20	27
AFRICA							
Algeria: Algiers	C	1					
Belgian Congo	C	54	4				
British East Africa:							
Kenya	C	4					
Nyasaland	C	2					
Uganda	C	299	11				
Egypt: Asyut Province	C	102		1		7	18
Madagascar	C	470					
Tunisia: Tunis	C	1					
Plague-infected rats		5					
Union of South Africa	C	74	6				
ASIA							
China:							
Fukien Province	D	[3] 753					
Manchuria	D	332					
Dutch East Indies:							
Java:							
Batavia	C	[2] 1					
Batavia Residency	D	[4] 84					
Java and Madura	C	1,491					
India	C	54,845					
Bassein	C	12					
Calcutta	C	[2] 1	[2] 1				
Cochin	C	1	2				
Plague-infected rats		1	8			2	1
Rangoon	C	[5] 8					[2] 1
Indochina (French)	C	2					
Thailand:							
Bichitr Province	C	4					
Bisnulok Province	C	35					
Kamphaeng Bajr Province	C		16	2	28		
Lampang Province	C	1					
Prae Province	C	6					
Svargalok Province	C	30					
Tak Province	C	10					

[1] Suspected.
[2] Imported.
[3] Includes 94 deaths from pneumonic plague.
[4] Pneumonic.
[5] Includes 1 imported case.

WORLD DISTRIBUTION OF CHOLERA PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE—Continued

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended— 6	13	20	27
NORTH AMERICA							
United States. (See issue of Feb. 9, p. 258.)							
SOUTH AMERICA							
Argentina:							
Jujuy Province	C	1					
Mendoza Province	C	1					
Salta Province	C	1					
San Luis Province	C	1					
Tucuman Province	C	1					
Bolivia	C	[4] 2	[6] 30				
Brazil:							
Alagoas State	C	43					
Bahia State	C	1					
Parahiba State	C	1					
Pernambuco State	C	32					
Sao Paulo State	C	1					
Ecuador.							
Chimborazo Province	C	24					
Riobamba	C	[4] 16					
Guayaquil	C	8					
Plague-infected rats		45					
Loja	C	4					
Puebla Viejo	C	3					
Peru:							
Cajamarca Department	C	9					
Lambayeque Department	C	8					
Libertad Department	C	26					
Lima Department	C	27					
Piura Department	C	30					
Venezuela [7]	C		3				
OCEANIA							
Hawaii Territory:							
Paauhau	C		[8] 1				
Plague-infected rats		47	7	1			1

SMALLPOX

[C indicates cases; D, deaths]

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended— 6	13	20	27
AFRICA							
Algeria	C	6					
Angola	C	104					
Belgian Congo	C	1,503	148				
British East Africa	C	680	2				
Dahomey	C	51					
Eritrea	C	2					
French Equatorial Africa	C	45					
French Guinea	C	40					
Gold Coast	C	141					
Ivory Coast	C	308	19				
Morocco	C	10					
Mozambique	C	86					
Nigeria	C	4,448	52				
Niger Territory	C	134					
Portuguese East Africa	C	24					
Portuguese Guinea	C	122					
Rhodesia:							
Northern	C	20					
Southern	C	140					
Senegal	C	256	1				
Sierra Leone	C	50					
Sudan (Anglo-Egyptian)	C	416	136		22		58
Sudan (French)	C	27					
Union of South Africa	C	209					

[4] Pneumonic.
[6] Oct. 1–Dec. 31, 1939.
[7] For the period Dec. 7, 1939, to Jan. 4, 1940, 11 cases of plague with 8 deaths were reported from the interior of Venezuela.
[8] Pneumonic plague; proved fatal.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX—Continued

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended— 6	13	20	27
ASIA							
Arabia	C	1					
Ceylon	C	1					
China	C	1,569	24	13	24		
Chosen	C	155					
India	C	101,647					
India (French)	C	59					
Indochina (French)	C	3,558	36				
Iran	C	66	19				
Iraq	C	51	40	5	6		
Japan	C	228	1				
Straits Settlements	C	1					
Syria	C	1					
Thailand	C	155					
EUROPE							
France	C	4					
Great Britain	C	1				1	
Greece	C	69					
Portugal	C	922	28	11			
Spain	C	464	256	9			
Canary Islands	C	3					
Turkey	C	388					
NORTH AMERICA							
Canada	C	156	4				
Guatemala	C	9					
Mexico	D	1,264					
Salvador	C	1					
SOUTH AMERICA							
Argentina	C	3					
Bolivia	C	187	[1] 60				
Brazil	C	13					
Colombia	C	2,740	8	9			
Ecuador	C	8					
Uruguay	C	5					
Venezuela	C	100	9				

TYPHUS FEVER

[C indicates cases; D, deaths]

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended— 6	13	20	27
AFRICA							
Algeria	C	1,820	46				
Belgian Congo	C			27			
British East Africa	C	2					
Egypt	C	4,017	101	31	29		68
Eritrea	C	9					
Libya	C	37					
Morocco	C	897	4				
Nigeria	C	2					
Portuguese East Africa	C	2					
Southern Rhodesia	C	3					
Swaziland	C	1					
Tunisia	C	6,021	83				
Union of South Africa	C	868					
ASIA							
China	C	293	15				
Chosen	C	734					
India	C	17		1			
Iran	C	68	1				
Iraq	C	47	2				
Palestine	C	164	34	2	1	3	1
Straits Settlements	C	14	1				
Sumatra	C	1					
Syria	C	5					
Trans-Jordan	C	19		1			

[1] Oct. 1–Dec. 31, 1939.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER—Continued

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended— 6	13	20	27
EUROPE							
Bulgaria	C	56					
France	C				1		
Greece	C	13					
Hungary	C	23				12	
Irish Free State	C	5					
Latvia	C	3					
Lithuania	C	153					
Poland	C	3,140					
Portugal	C	18					
Rumania	C	816	126	39	60		
Spain	C	54	5				
Turkey	C	305					
Yugoslavia	C	379	25				
NORTH AMERICA							
Cuba	C		[1] 1				
Guatemala	C	190	52				
Mexico	D	341	1				1
Panama Canal Zone	C	3					
SOUTH AMERICA							
Bolivia	C	93	[2] 69				
Chile	C	1,144					
Peru	C	197					
Venezuela	C	10					
OCEANIA							
Australia	C	23	1				
Hawaii Territory	C	30	6	1			

YELLOW FEVER

[C indicates cases; D, deaths]

Place		Jan. 1–Nov. 30, 1939	December 1939	January 1940—week ended— 6	13	20	27
AFRICA							
Cameroon:							
Bafia	C	1					
Nkongsamba	C						[3] 1
French Equatorial Africa:							
Bangui	C	[3] 1					
Chad—Fort Lamy	C	1					
Fort Archambault	C				[4] 2		[3] 1
Gabon	D	1					
French Guinea	C	2					
Gold Coast	C	2					
Ivory Coast	C	[5] 23	[4] 2	1			
Nigeria	C	[6] 10	1				
Niger Territory:							
Dosso	C	3					
Konni Circle	C	3					
Tahua	C	[3] 1					
Senegal:							
Bambey	C	1					
Dakar	C	[3] 1					
Diourbel	C	6					
Louga	C		[3] 1				
Ziguinchor	C	10					
Sudan (French): Bandiagara	C	1					
Togo (French): Anecho	C	1					
SOUTH AMERICA							
Brazil:							
Amazonas State	D	[7] 1					
Bahia State	D	[7] 1					
Espirito Santo State	D	96	[7] 8				
Minas Geraes State	D	13					
Para State	D	3					
Rio de Janeiro State	D	3					
Colombia: Antioquia Department—							
Caracoli	D	2	1				
Jordan	D		1				
San Carlos	D	5	1				

[1] Exact date not given.
[2] Oct. 1–Dec. 31, 1939.
[3] Suspected.
[4] Includes 1 suspected case.
[5] Includes 7 suspected cases.
[6] Includes 3 suspected cases.
[7] Jungle type.

Public Health Reports

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IN THIS ISSUE

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UNITED STATES PUBLIC HEALTH SERVICE

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Public Health Reports

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A STUDY OF PNEUMOCOCCUS TYPING SERUMS FOR THE PURPOSE OF STANDARDIZING A TEST FOR POTENCY[1]

By BERNICE E. EDDY, *Associate Bacteriologist, United States Public Health Service*

Since the identification of the types of pneumococci other than I, II, and III by Cooper and her coworkers (*1, 2, 3, 4*) the problems of the preparation and standardization of pneumococcus typing serums have increased in number and importance. An accurate survey of prevalence and mortality due to the different types and the success of treatment with therapeutic serums is, first of all, dependent upon specific and potent typing serums.

Early in the investigations on specific types it was noted that many serums showed cross reactions; that is, they caused an agglutination or capsular swelling reaction not only with the homologous type pneumococcus but with one or more heterologous types of pneumococci as well. Some cross reactions appeared regularly as a characteristic of certain type strains of pneumococci, for example, types II and V, and types III and VIII (*3, 4, 5, 6*). Other cross reactions were found in the serum of certain individual animals and have not been explained satisfactorily. Cooper used absorption tests for checking cross agglutination reactions during her studies on the "higher" types that had previously made up the old group IV pneumococci. When the Neufeld test came into use as a means of typing it was found that absorption of the serum removed the factor responsible for the Neufeld reaction as well as the agglutinins.

The tests for cross reactions remain a laborious necessity to be carried out on every pneumococcus typing serum, but the removal of a cross reaction can be accomplished once it is found. The techniques for absorption vary, but in general the procedure consists in adding a dense suspension of pneumococci of the heterologous type giving the cross reaction to the serum. After agglutination and capsular swelling of the added pneumococci occur, the bacteria are removed from the serum.

[1] From the Division of Biologics Control, National Institute of Health.

The task of setting a standard for the potency of typing serum proved more difficult. Different laboratories worked out their own methods of standardization and minimum requirements, but they varied one from another.

The attack on the problem was begun in this laboratory by collecting samples of typing serums produced in the commercial laboratories and testing them by different methods. The methods first used were modifications of the regular Neufeld test as described by Bullowa (*6*), and of a potency test described by Clapp, Phillips, and Stahl (*7*). As the work progressed the techniques were changed gradually until a practical standard method of procedure was adopted.

In the early tests a 1-mm. loopful of peritoneal fluid of a mouse, moribund following inoculation with an homologous type of pneumococcus, was placed on a glass cover slip. To this was added a 3-mm. loopful of diluted pneumococcus typing serum and a 3-mm. loopful of Loeffler's methylene blue. After thorough mixing the cover slip was inverted onto a clean flat glass slide. The preparations were incubated at 37° C. for 30 minutes and examined microscopically The end point taken was the highest dilution of serum producing definite capsular swelling. It was soon observed that, while it was possible for one individual to place approximately the same amount of peritoneal fluid on the cover slip each time and thus obtain about the same titer, unless great care was taken it was easy to use more or less peritoneal fluid and obtain widely differing titers. Moreover, the peritoneal fluid of some infected mice contained more leucocytes and more bacteria than other mice so that even when the same loop was used for transferring the peritoneal fluid the titers often varied.

The next tests were performed with broth cultures of pneumococci substituted for the peritoneal fluid of a mouse. The titers obtained with broth cultures were not always the same. If the growth was exceedingly heavy the titer would be lower than if the growth was light. Also, among the various types there were great differences in the appearance of the swollen capsules on pneumococci grown in different lots of broth, with different enrichment media, and in cultures grown for different lengths of time.

It became apparent that there was a need for defining positive and negative Neufeld reactions for purposes of determining potency. A positive reaction was therefore considered to be one in which a preparation showed approximately 90 percent of the pneumococci to have swollen, glassy capsules of a greenish hue with as distinct and definite outlines as those produced by a known positive undiluted rabbit serum. If less than 90 percent of the pneumococci exhibited swollen capsules or if the swollen capsules had hazy, indefinite outlines the test was regarded as negative.

Some lots of broth supported the growth of pneumococci with better capsules than those grown in other lots. The cause of this difference in lots of broth prepared in the same way was not explained Satisfactory batches of broth were set aside for the preparation of antigens.

Enrichment of broth with blood or serum increased the amount of growth of the pneumococci but added the disadvantage that more debris appeared in the preparations made from such cultures and the end points were often more difficult to read. On the other hand, the addition of dextrose to the broth was distinctly beneficial for the production of satisfactory antigens. Five-tenths percent of dextrose was used. It was noted, furthermore, that when dextrose broth was heavily inoculated with pneumococci and grown but a short time (not less than 1 hour and never more than 5 hours) larger and more definite capsules were present than when a light inoculation of pneumococci was made and the cultures were incubated for a longer period.

Heavy inoculation was accomplished by growing the pneumococci on dextrose blood agar slants from 8 to 12 hours and washing off the growth with 7 cc. of dextrose broth. For types with large capsules, such as types III and XXVII, it was important to remove the cultures from the incubator as soon as, or a little before, they reached their maximum turbidities, or the swollen capsules appeared to have misshapen or fragmented outlines. For types with small capsules, such as types V and XXIV, this precaution was less important.

For preserving the antigens 1.43 percent of a solution of formaldehyde, U. S. P. (0.1 cc. to 7 cc. of culture) was used throughout all the experiments although it will be shown that this exact concentration of formaldehyde was not important. The pneumococci in some of the antigens thus preserved and stored in the refrigerator remained in suspension and retained their normal capsular swelling properties for 2 weeks or more. In others they settled to the bottom of the tube and showed evidences of degeneration within a short time. As a precaution, no antigen was used after it was 4 days old.

It appeared likely that the Neufeld reaction was a quantitative one, depending upon the amount of capsular material to be swollen as well as the amount of antibody present in the serum. For practical purposes, a simple means of measuring the capsular material in the antigen was to measure the turbidity of the dextrose broth culture, using only fully virulent pneumococci from young cultures that possessed good capsules. Any debris present necessarily lessened the number of pneumococci and reduced the capsular material to be swollen. For this reason, after incubation and the addition of formalin the antigen was placed in the refrigerator from 2 hours to overnight to allow any debris from the blood agar or any other extrane-

ous particles or degenerated pneumococci to settle out. After the period at refrigerator temperature, the supernatant fluid containing the pneumococci was diluted with a solution of peptone, sodium chloride, and formaldehyde [2] to match a turbidity standard of 1,000 parts per million of silica (*8*). This was further diluted to match turbidity standards of 800, 600, 400, 200, 100, and 50 parts per million of silica, respectively. Serum dilutions were made in twofold increments in physiological saline solution buffered to pH 7.6. For the test, 0.1 cc. of an antigen was quickly mixed with 0.1 cc. of a serum dilution. Two loopfuls [3] of the mixture were placed on a cover slip and a small loopful [4] of saturated aqueous methylene blue was mixed with it. The cover slip was inverted on a flat glass slide and the preparation was examined under the microscope at once. A sample of the results is shown in table 1. Roughly, doubling the turbidity of the antigen resulted in lowering the titer of the serum one-half, or, conversely, decreasing the turbidity of the antigen by one-half doubled the titer of the serum. This factor of variation of the pneumococci in an antigen must explain, at least in part, the great differences in the titers that have been assigned to the same serum by different laboratories.

TABLE 1.—*The protocol of a test showing the influence of the turbidity of an antigen upon the titer of a serum*

Type II antipneumococcic rabbit serum dilutions	Type II antigen diluted to match turbidity standards of—						
	50 p.p.m. silica	100 p.p.m. silica	200 p.p.m. silica	400 p.p.m. silica	600 p.p.m. silica	800 p.p.m. silica	1,000 p.p.m silica
1:4	+	+	+	+	+	+	±
1:8	+	+	+	+	+	±	0
1:16	+	+	+	+	±	0	0
1:32	+	+	+	0	0	0	0
1:64	+	±	0	0	0	0	0
1:128	±	0	0	0	0	0	0
1:256	0	0	0	0	0	0	0
Titer	1:64+	1:32+	1:32	1:16	1:8+	1:4+	<1:4

+ = Positive. Swollen capsules with definite outlines equal in size to those produced by undiluted homologous rabbit serum.
± = Almost positive. The capsules not as wide or the outlines not as definite as those produced by the undiluted control serum.
0 = Negative. No swollen capsules or swollen capsules with only hazy, indistinct outlines.

An antigen corresponding to a turbidity standard of 200 parts per million of silica contained enough pneumococci so that when two 3-mm. loopfuls of the serum-antigen mixture were placed on a slide many pneumococci were present in each field yet they were not greatly crowded. It was easy to note at a glance whether all the pneumococci had swollen capsules with definite outlines, whether

[2] The solution contained 1 percent peptone, 0.5 percent sodium chloride and 1.43 percent of a solution of formaldehyde, U. S. P., and was buffered to pH 7.6.
[3] A loop of 26-gage platinum, 3 mm. inside diameter.
[4] A loop of 28-gage platinum, 1 mm. inside diameter.

there were any that showed no swollen capsules, or whether agglutination had occurred. Thus, for the sake of convenience, an antigen corresponding to a turbidity standard of 200 parts per million of silica was chosen as the standard antigen for potency tests.

In order to make each antigen as uniformly equal to the turbidity standard as possible, 2 cc. of the supernatant suspension of pneumococci were removed from the stock antigen and 1 cc. was diluted with physiological saline solution to match the turbidity standard. A quantity of peptone solution equal to the quantity of saline solution required to make the dilution was added to the remaining 1 cc. of stock antigen and was used for the tests. This procedure made it possible to eliminate any error due to matching the turbidity of the pneumococci in the amber-colored peptone solution with the colorless turbidity standards. Table 2 shows that the results of tests carried out on serums with carefully standardized antigens prepared on different days were essentially the same.

TABLE 2.—*Results of testing serums with carefully standardized antigens prepared from homologous types of pneumococci on different days*

Antipneumococcic rabbit serum	Date of test	Titer	Antipneumococcic rabbit serum	Date of test	Titer
Type I, lot A	Oct. 21, 1938	1:35	Type XIII (concentrated), lot A	Dec. 2, 1938	1:180
	Oct. 27, 1938	1:40		Jan. 19, 1939	1:180
	Dec. 23, 1938	1:35	Type XIV (concentrated) lot A	Nov. 15, 1938	1:200
Type III (concentrated), lot A	Nov. 8, 1938	1:50		Nov. 29, 1938	1:180
	Nov. 10, 1938	1:50	Type XVI, lot A	Apr. 28, 1939	1:16
	Dec. 16, 1938	1:50		May 3, 1939	1:16
	Feb. 21, 1939	1:50	Type XIX (concentrated), lot A	Nov. 10, 1938	1:230
Type III (concentrated), lot B	Oct. 24, 1938	1:40		Jan. 12, 1939	1:180
	Oct. 25, 1938	1:35	Type XX (concentrated), lot A	Jan. 16, 1939	1:200
	Nov. 8, 1938	1:40		Jan. 18, 1939	1:180
Type V, lot A	Jan. 31, 1939	1:20	Type XXV, lot A	Apr. 26, 1939	1:4+
	Feb. 14, 1939	1:16		May 2, 1939	1:4+
Type VIII, lot A	July 7, 1939	1:8+	Type XXVIII, lot A	Apr. 28, 1939	1:8
	Aug. 4, 1939	1:8+		May 2, 1939	1:8
Type IX (concentrated), lot A	Jan. 16, 1939	1:140		May 6, 1939	1:8+
	Jan. 17, 1939	1:160			
	Jan. 19, 1939	1:180			

Clinically, pneumococci are typed from sputum whenever possible. For this reason it was of interest to find out whether a viscous material, such as is usually found in sputum from pneumonia patients, interfered in any way with the combination of capsular substance and antibody. Table 3 shows that approximately 5.2 percent of mucin interfered to the extent that the titer of the serum was reduced by one-half. The lower concentrations of mucin did not lower the titer of the serum but the end points were difficult to read because the outlines of many of the capsules were obscure.

That this interference with the Neufeld reaction was not a characteristic of mucin alone was shown when a viscous material composed of a 50 percent aqueous solution of dextrose was used for diluting the

stock antigen or serum, or both. It will be noted that as the concentration of the dextrose was increased the titer of the serum was decreased (table 3a). Unlike the preparations containing mucin, the end points of the preparations containing dextrose were easily read.

TABLE 3.—*Effect of different concentrations of mucin on the titer of a serum*

Dilutions of antipneumococcic rabbit serum type, II, lot B	Control (no mucin)	Mucin approximately 2.2 percent	Mucin approximately 3 percent	Mucin approximately 5.2 percent
	Stock antigen diluted 1:4 with peptone solution, serum diluted with saline solution	Stock antigen diluted 1:4 with 6 percent mucin, serum diluted with saline solution	Stock antigen diluted 1.4 with peptone solution, serum diluted with 6 percent mucin	Stock antigen diluted 1:4 with 6 percent mucin, serum diluted with 6 percent mucin
1:8	+	+	+	[1] +
1:16	+	[1] +	[1] +	0
1:32	0	0	0	0
Titer	1:16	[1] 1:16	[1] 1:16	[1] 1:8

[1] End point difficult to read.

TABLE 3a.—*Effect of different concentrations of dextrose on the titer of a serum*

Dilutions of antipneumococcic rabbit serum, type II, lot A	Control (no dextrose)	Dextrose approximately 18.7 percent	Dextrose approximately 25 percent	Dextrose approximately 43.7 percent
	Stock antigen diluted 1:4 with peptone solution, serum diluted with saline solution	Stock antigen diluted 1:4 with 50 percent dextrose solution, serum diluted with saline solution	Stock antigen diluted 1:4 with peptone solution, serum diluted with 50 percent dextrose solution	Stock antigen diluted 1:4 with 50 percent dextrose solution, serum diluted with 50 percent dextrose solution
1:4	-	-	-	+
1:8	-	-	+	+
1:16	+	+	+	±
1:32	+	0	0	0
1:64	0	0	0	0
Titer	1:32	1:16	1:16	1:8+

From the results of the tests with mucin and dextrose it seemed reasonable to conclude that in specifying the minimum requirements for the potency of pneumococcus typing serums some allowance should be made for the fact that the pneumococci in sputums are often surrounded by a thick tenacious material, and therefore require a stronger serum than if they were suspended in a liquid such as broth or peptone solution. It did not seem practicable to employ a viscous material for the dilution of the antigen or serum in potency tests, since such a diluent would involve standardization of the preparation and viscosity of the material. If a satisfactory standardization of the material could be accomplished, it would still not correspond to the interfering substances that might be present in sputums, since sputums vary widely, even from the same patient.

Methylene blue being a factor in the Neufeld test, an effort was made to determine what effect different concentrations and amounts added at different stages of the test might have upon the titer of a serum. It was observed that methylene blue could be used with equal success in different amounts, depending upon the concentration, for the regular Neufeld test performed with undiluted rabbit serum. The same amounts of solutions of methylene blue were added on the cover slip to the serum-antigen mixtures in tests for the potency of typing serums. Inasmuch as each serum-antigen mixture was further diluted on the cover slip by the dye solution, tests were carried out to determine the effect of this dilution. First, the methylene blue was added to the saline solution used for making the serum dilutions, making any further dilution of the serum-antigen mixture unnecessary, and, second, the volume of the serum-antigen mixtures in the test tube was increased four times by the addition of saline solution containing methylene blue. Tests were also performed in which methylene blue was added to the antigen before it was mixed with the serum dilution to find out whether the capsules appeared more distinct if the pneumococci were stained before the capsules were swollen rather than afterwards. The results are given in table 4. It will be noted (columns 1, 2, and 3) that the amounts of methylene blue solution that were satisfactory for demonstrating the swollen capsules in the regular Neufeld test served equally well in quantitative capsular swelling tests and (columns 4 and 5) that the added dilution of the serum-antigen mixture by the methylene blue solution had no effect upon the titer of a serum. On the other hand, coloring the pneumococci before the capsules were swollen (column 6) was sometimes a disadvantage. The outlines of the swollen capsules were often more indistinct and the end points were difficult to read.

To determine whether formalin influenced the results of the assay of a serum, a series of experiments was carried out with a portion of a stock antigen to which 1.43 percent of a solution of formaldehyde, U. S. P., was added and with a portion which contained no solution of formaldehyde. The results were the same, as is shown in table 5. It may be stated, however, that some differences might have occurred had not other precautions been taken for preserving the antigens. Antigens were kept in the refrigerator at all times when not in use and in an iced container while being used. They were used for a period not longer than 4 days and only when the pneumococci remained in the broth suspension; antigens in which the pneumococci had settled to the bottom of the tube were discarded.

A series of experiments was also carried out with antigens to which were added 0.25, 0.5, and 1.43 percent, respectively, of a solution of formaldehyde (table 5). No advantage of one concentration over the other was noted. The results were in keeping with those of

TABLE 4.—*Comparison of quantitative Neufeld reactions when different concentrations of methylene blue were added after the serum-antigen mixtures were made and when methylene blue was added to the serum dilutions or antigen before the serum-antigen mixtures were made*

Antipneumococcic rabbit serum dilutions		Methylene blue solutions added to serum-antigen mixture on cover slip			Methylene blue solution added to serum-antigen mixture in test tube to increase the serum dilution 4 times	Methylene blue solution added to saline solution used for making serum dilution	Methylene blue solution added to antigen before serum-antigen mixture was made
		Two 3-mm. loopfuls of serum-antigen mixture + one 1-mm. loopful of saturated aqueous methylene blue	Two 3-mm. loopfuls of serum-antigen mixture + one 3-mm. loopful of 10 percent saturated aqueous methylene blue	Two 3-mm. loopfuls of serum-antigen mixture + one 5-mm. loopful of Loeffler's methylene blue	0.2 cc. of serum-antigen mixture + 0.6 cc. methylene blue solution (0.5 cc. saturated aqueous methylene blue to 9.5 cc. saline)	(1 cc. of saturated aqueous methylene blue to 25 cc. of saline)	Antigen equal to a silica standard of 400 p. p. m. diluted with equal parts of a solution containing 1.5 cc. of saturated aqueous methylene blue in 8.5 cc. of peptone solution
Type I, lot B	1:8	+	+	+	----	----	----
	1:16	+	+	+	----	----	----
	1:32	+	+	+	----	----	----
	1:64	0	0	0	----	----	----
	1:128	0	0	0	----	----	----
Titer		1:32	1:32	1:32	----	----	----
Type I, lot C	1:8	+	----	----	+	----	----
	1:16	+	----	----	+	----	----
	1:32	±	----	----	±	----	----
	1:64	0	----	----	0	----	----
Titer		1:16+	----	----	1:16+	----	----
Type XXVIII, lot B	1:4	----	+	----	----	+	----
	1:8	----	0	----	----	0	----
Titer		----	1:4	----	----	1:4	----
Type XXXII, lot A	1:4	----	+	----	----	+	----
	1:8	----	+	----	----	+	----
	1:16	----	+	----	----	+	----
	1:32	----	+	----	----	+	----
	1:64	----	0	----	----	0	----
Titer		----	1:32	----	----	1:32	----
Type XIV, concentrated.	1:160	----	----	----	----	----	+
	1:170	+	----	----	----	----	+
	1:180	+	----	----	----	----	0
	1:190	0	----	----	----	----	0
	1:200	0	----	----	----	----	0
Titer		1:180	----	----	----	----	1:170
Type I, lot B	1:8	+	+	+	+	+	+
	1:16	+	+	+	+	+	+
	1:32	±	±	±	±	±	0
	1:64	0	0	0	0	0	0
Titer		1:16+	1:16+	1:16+	1:16+	1:16+	1:16
Type II, lot C	1:8	+	+	+	+	+	+
	1:16	+	+	+	+	+	+
	1:32	±	±	±	±	±	0
	1:64	0	0	0	0	0	0
Titer		1:16+	1:16+	1:16+	1:16+	1:16+	1:16
Type VIII, lot B	1:16	+	+	+	+	+	+
	1:32	+	+	+	+	+	+
	1:64	0	0	0	0	0	0
Titer		1:32	1:32	1:32	1:32	1:32	1:32
Type XXXII, lot B	1:16	+	+	+	+	+	+
	1:32	±	±	±	±	±	0
	1:64	0	0	0	0	0	0
Titer		1:16+	1:16+	1:16+	1:16+	1:16+	1:16+

Barnes and Hager (quoted by White (*9*)) who found that the amount of combined formaldehyde was the same irrespective of whether 0.2, 0.3, 0.4, or 0.5 percent of formalin had been added to a culture of pneumococci.

TABLE 5.—*Assay of antipneumococcic serums with antigens containing no formaldehyde and with antigens containing different concentrations of a solution of formaldehyde*

Antipneumococcic rabbit serum dilutions		No formaldehyde	0.25 percent of a solution of formaldehyde U. S. P.	0.5 percent of a solution of formaldehyde U. S. P.	1.43 percent of a solution of formaldehyde U. S. P.
Type I (concentrated) lot E	1:32	+			+
	1:64	+			+
	1:128	+			+
	1:256	0			0
Titer		1:128			1:128
Type IX, lot B	1:32	+			+
	1:64	+			+
	1:128	0			0
Titer		1:64			1:64
Type XXVII, lot A	1:32	+			+
	1:64	+			+
	1:128	0			0
Titer		1:64			1:64
Type III, lot C	1:16				+
	1:32		+	+	+
	1:64		0	0	0
Titer			1:32	1:32	1:32
Type VIII, lot C	1:16		+	+	+
	1:32		±	±	±
	1:64		0	0	0
Titer			1:16+	1:16+	1:16+
Type II, lot A	1:32		+	+	+
	1:64		0	0	0
Titer			1:32	1:32	1:32
Type III, lot D	1:16		+		+
	1:32		+		+
	1:64		0		0
	1:128		0		0
Titer			1:32		1:32

Throughout all the investigations, the peptone solution used for diluting the antigens and the saline solution used for diluting the serums were adjusted to pH 7.6. The final pH of the antigen was in most cases somewhat less than pH 7.6, owing to acids produced by growth of the pneumococci in the dextrose broth medium. Whether or not the variation of pH was a factor of any importance was tested in the following manner: Portions of a stock antigen were adjusted with hydrochloric acid or sodium hydroxide to pH 5.6, 7.6, and 8.0, respectively, and diluted to match a silica turbidity standard of 200 parts per million with peptone solutions of the same pH values. Triplicate serum dilutions were then made with physiological saline solution buffered to pH 5.6, 7.6, and 8.0, and tests were performed with the antigen and serum dilutions of each corresponding pH value (table 6). The pH values tested had no effect upon the quantitative Neufeld reaction under the conditions of the experiments.

That the pH may be a factor in the keeping qualities of antigens was suggested. When antigens adjusted to pH 5.6, 7.6, and 8.0 were observed after they had remained in the refrigerator for a period of

3 weeks, the majority of the pneumococci in the more alkaline suspensions, pH 7.6 and 8.0, had dropped to the bottom of the tube, whereas little sedimentation had occurred in the suspension of pH 5.6. Also, the pneumococci in some of the more alkaline antigens, when tested with homologous type serums, exhibited more swollen capsules with misshapen or ragged outlines than the swollen capsules in the antigens adjusted to pH 5.6. Other factors involved in the keeping qualities of antigens for periods of 2 to 3 weeks, or longer, were not investigated.

TABLE 6.—*Assay of a serum with antigens and saline solution used for making the serum dilutions adjusted to pH 5.6, 7.6, and 8.0, respectively*

Antipneumococcic rabbit serum dilutions		pH 5.6	pH 7.6	pH 8.0
Type II, lot A	1:4	+	+	+
	1:8	+	+	+
	1:16	+	+	+
	1:32	+	+	+
	1:64	0	0	0
	1:128	0	0	0
Titer		1:32	1:32	1:32
Type III (concentrated), lot E	1:32	+	+	+
	1:64	±	±	±
	1:128	0	0	0
Titer		1:32+	1:32+	1:32+

The question of whether enough soluble specific substance was dissolved in the culture medium to cause a variation in the titer of a serum was considered. Stock antigens were prepared as usual and portions were adjusted to pH 5.6, 7.6, and 8.0, respectively, diluted with peptone solutions of the same pH values, and the antigens of pH 5.6 and 8.0 and portions of the antigen of pH 7.6 were centrifugalized. The clear supernatant fluid of each tube was decanted and the sedimented pneumococci were resuspended in the same amount of peptone solution of the respective pH previously used (table 7). With the exception of one test, no differences in the titer of a serum were observed when antigens of pH 5.6, 7.6, and 8.0, centrifugalized and resuspended in peptone solution of the same pH, were used. This exception was with antigens in which many of the pneumococci showed damaged swollen capsules when tested with an homologous type serum and the end points were difficult to read.

There were differences in 4 of 6 tests, however, when antigens which had not been centrifugalized were compared with those which had. In one test some of the pneumococci in the centrifugalized antigen exhibited only slightly swollen capsules or swollen capsules with fragmented outlines when tested with the higher dilutions of the homologous type serum. For this reason, the titers of the serum were lower as judged by the usual method of regarding as positive only preparations in which approximately 90 percent of the pneu-

mococci showed swollen capsules with definite outlines. In 3 tests the titers of the serums tested with antigens which had been centrifugalized and resuspended in peptone solution were higher. It is probable that in these experiments some of the capsular material or pneumococci were lost in removing the supernatant liquid from the centrifugalized antigens.

TABLE 7.—*Comparisons of the titers of serums tested with antigens adjusted to pH 5.6, 7.6, and 8.0, centrifugalized and resuspended in peptone solution of the same pH values and antigens which had not been centrifugalized, adjusted to pH 7.6*

Antipneumococcic rabbit serum dilutions		Antigens not centrifugalized	Antigens centrifugalized and resuspended in peptone solution		
		pH 7.6	pH 5.6	pH 7.6	pH 8.0
Type II, lot A	1:16	---	---	+	---
	1:32	+	+	+	+
	1:64	0	±	±	±
	1:128	0	0	0	0
Titer		1:32	1:32+	1:32+	1:32+
Type II, lot A	1:32	+	---	+	+
	1:64	0	---	0	0
Titer		1:32	---	1:32	1:32
Type III, lot F	1:8	+	---	---	+
	1:16	+	+	+	±
	1:32	+	±	±	0
	1:64	0	0	0	0
	1:128	0	0	0	---
Titer		1:32	1:16+	1:16+	1:8+
Type III, lot F	1:16	+	---	+	---
	1:32	+	+	+	+
	1:64	0	+	+	+
	1:128	0	+	+	+
	1:256	0	0	0	0
Titer		1:32	1:128	1:128	1:128
Type V, lot B	1:8	+	---	+	---
	1:16	+	+	+	+
	1:32	±	±	±	±
	1:64	0	0	0	0
	1:128	0	0	0	0
Titer		1:16+	1:16+	1:16+	1:16+
Type VIII, lot C	1:16	+	+	+	+
	1:32	±	+	+	+
	1:64	0	0	0	0
Titer		1:16+	1:32	1:32	1:32

That the titer of a serum was not consistently higher or lower when tested with an antigen which had been centrifugalized and resuspended in peptone solution was shown in two instances with antigens prepared and tested at different times. For both serums, the titers obtained with the antigens prepared on different days which had not been centrifugalized were the same, but in neither test were the titers obtained with the antigens centrifugalized and resuspended in peptone solution the same. It was concluded, therefore, that centrifugalizing and resuspending the pneumococci in an antigen was a time-consuming procedure more prone to introduce an error than to correct one.

Taking into consideration the factors of the Neufeld reaction which had been investigated, a standard test was evolved and adopted for

testing the potency of diagnostic pneumococcus serums of all types received from the different laboratories. The test was as follows

Materials.—The saline solution used for diluting the antipneumococcus rabbit serum was a solution of 0.85 percent sodium chloride buffered to pH 7.6.

The methylene blue was a saturated aqueous solution.

The antigen was prepared by washing the growth of fully virulent pneumococci from an 8- to 18-hour dextrose blood agar slant with 7 cc of 0.5 percent dextrose broth that had previously been tested for supporting good growth and capsule production of pneumococci. The broth culture was incubated at 37° C. from 1 to 5 hours (never over 5 hours), depending upon the turbidity. Care was taken, particularly for types with large capsules, that the broth cultures were removed from the incubator as soon as, or a little before, the maximum turbidity was reached. The pneumococci were killed by adding 0.1 cc of a solution of formaldehyde, U. S. P., to each 7 cc. of culture (1.43 percent). After the addition of the formaldehyde the antigen was stored in the refrigerator for at least 2 hours and usually overnight. Before use, 2 cc. of the supernatant suspension were pipetted off and 1 cc. was diluted with saline solution to match as exactly as possible a turbidity standard containing 200 parts per million of silica. This tube was discarded. To the remaining 1 cc a quantity of peptone solution[5] was added that was equal to the quantity of saline solution required to match the turbidity standard. This antigen was tested with undiluted rabbit serum of the homologous type and if the pneumococci were found to have swollen, glassy capsules of a greenish hue with definite outlines, the antigen was considered satisfactory for the test. Such swollen capsules were used as standards for judging the capsular swelling of each serum dilution.

The antigen was kept in the refrigerator when not in use and in an iced container while being used. It was not used for longer than 4 days, and was not used after the pneumococci dropped out of suspension or after the capsules of the pneumococci swollen by the homologous type serum appeared to have outlines that were fragmented or hazy and indistinct

The test.—One-tenth cc. of the serum of half the dilution being tested and 0.1 cc. of the antigen were mixed well in a small test tube. Two loopfuls[6] were placed on a cover slip and a small loopful[7] of saturated aqueous methylene blue was mixed with it. The cover slip was inverted on a flat glass slide and the preparation examined under the microscope after 2 to 4 minutes.

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[5] This solution contained 1 percent peptone, 0.5 percent sodium chloride, and 1.43 percent of a solution of formaldehyde, U. S. P., and was buffered to pH 7.6.

[6] A loop of 26-gage platinum, 3 mm. inside diameter.

[7] A loop of 26-gage platinum 1 mm. inside diameter.

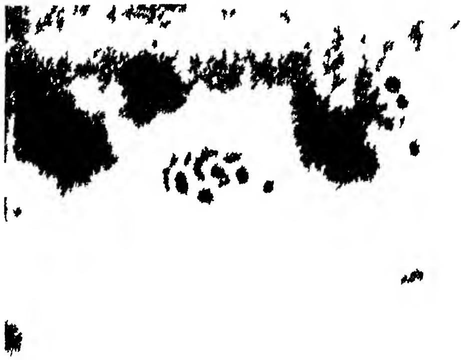

FIGURE 1—Positive Neufeld reaction The capsules are swollen by undiluted rabbit serum of the homologous type Note the wide capsules with definite outlines

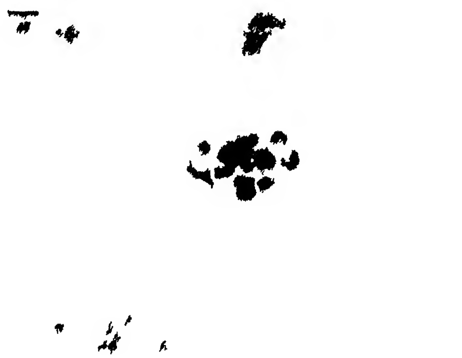

FIGURE 2—Plus minus Neufeld reaction The capsules are not as wide or the outlines are not as definite as those produced by the undiluted control serum

FIGURE 3—Negative Neufeld reaction Some of the pneumococci have slightly swollen capsules but the outlines are hazy and indistinct

The only preparations regarded as positive were those in which at least 90 percent of the pneumococci exhibited swollen capsules as definite and distinct as those produced by a known positive undiluted rabbit serum of the homologous type. If the number of pneumococci with definitely swollen capsules was less than 90 percent, or if the outlines of the capsules were hazy and indistinct, the serum dilution was read as negative. Border-line preparations in which the outlines of the swollen capsules failed to be quite as distinct or in which the capsules failed to be quite as wide as those produced by the undiluted control serum were read plus-minus (figs. 1, 2, and 3).

Particular attention was necessary in reading the results of tests with pneumococci having large capsules, for example, types III and XXVII. Several fields were examined to make certain that each serum dilution caused at least 90 percent of the pneumococci to have swollen capsules with definite outlines. Sometimes in high dilutions of serum a few of the pneumococci would show large definitely swollen capsules while the remainder would show none.

Types of pneumococci showing narrow swollen capsules when tested with homologous type serum, such as types V, XIV, and XXIV, were found to swell somewhat more slowly than pneumococci with wide capsules. A time limit of 2 to 4 minutes was, however, sufficient for these types.

The antipneumococcus typing serums assayed by this method revealed that the titers ranged from 0 to, in a few serums, 1:128. In other words, some of the undiluted serums produced only slightly swollen capsules, with outlines too indistinct to be regarded as positive by the adopted definition of a positive Neufeld reaction. With the exception of the type III monovalent serums, titers of 1:4 to 1:8 were most frequently encountered for all types. Type III serums were uniformly low in potency.

After completion of tests of all the typing serums collected and collection of data concerning the use of different typing serums in clinical laboratories, an arbitrary titer for the minimum requirement for all types except type III was placed at 1:16 for monovalent serums and 1:8 for typing serum mixtures. The potency for monovalent type III serum and for type III in serum mixtures was placed at 1:8 and 1:4, respectively.

As the Neufeld test is carried out in most clinical laboratories more typing serum than sputum or mouse peritoneal fluid is used. Taking this fact into consideration, the arbitrary minimum titers chosen for typing serums allow a small margin of safety for obtaining a positive reaction when sputum is unusually thick and tenacious, when large numbers of pneumococci of the homologous type are present, and for deterioration due to such little investigated factors as aging, temperature, or light. It may be mentioned that the titers chosen for the

minimum requirements were higher than the titers of many of the typing serums available in 1937 and 1938.

DISCUSSION

The experiments demonstrate that the most important factors in the test of potency of pneumococcus typing serums are the careful preparation and standardization of the antigen and uniformity in reading the results. In other words, the Neufeld reaction represents a quantitative combination of the capsular component of the pneumococcus and the antibody in the serum. Some measure, direct or indirect, of the capsular component must be made if the amount of antibody is to be estimated. In general, reducing the turbidity of the antigen by one-half (or the capsular material by one-half) doubles the titer of a serum.

This quantitative relationship of capsular substance and antibody is in keeping with the technique of typing pneumococci from sputum or other pathological materials considered as satisfactory by Cooper and Walter (*4*); they used 4 to 40 times as much serum as sputum or other pathological material. It is again suggested in the warning by White (*10*) that in dealing with sputum in which many type III organisms are present it is sometimes necessary to dilute the sputum with salt solution before any swelling of the pneumococcus capsule is evident.

In reading the results attention has been drawn to the importance of a swollen capsule with a definite outline, rather than simply a swollen capsule. The definiteness of the outline is dependent principally upon the potency of the serum. The width of a swollen capsule is usually characteristic of the type of the pneumococcus, although the virulence of the strain, the age of the culture, and the medium in which it is grown affect the capsular width. It is because of the differences in width of the swollen capsules that an undiluted homologous-type rabbit serum should be used as a control for judging whether each test serum dilution is negative or positive.

The fact that two viscous materials, mucin and a concentrated solution of dextrose, interfered with the Neufeld reaction was of interest because of the practice of typing pneumococci from sputum, mouse peritoneal fluid, or other pathological materials that are often thick and viscous. While it is not practicable to use a viscous material as a diluent for either the antigen or serum dilutions in tests for the potency of pneumococcus typing serums it was a point that was considered when the arbitrary minimum standards were chosen.

The experiments in which different concentrations of methylene blue were added to the serum-antigen mixtures show that methylene

blue added after the serum-antigen mixture is made has no essential effect except to dye the pneumococci and bring out the swollen capsules. That the further dilution of the serum due to the addition of the methylene blue solution to the serum-antigen mixture does not influence the results tends to simplify the standard test. Methylene blue can be added to the saline solution used for making the serum dilutions, but no advantage is derived from it. The end points are sometimes lower and more difficult to read when methylene blue is added to the antigen before the serum-antigen mixtures are made.

The experiments demonstrating that the concentration of formalin in the antigen or the hydrogen ion concentration of the test materials can be varied over a considerable range without affecting the titer of a serum make the proposed test of potency easier to duplicate. It is to be borne in mind, however, that the antigens are not used for a period longer than 4 days.

CONCLUSIONS

1. A quantitative Neufeld test for determining the potency of pneumococcus typing serum is described.
2. Minimum requirements for monovalent pneumococcus typing serums and for group typing serum mixtures are proposed.

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YELLOW FEVER

By J. H. Bauer, *in charge of the Laboratories of the International Health Division of the Rockefeller Foundation, New York, N. Y.*

Yellow fever is a disease with which the general public is not very familiar at present. In the past it was a terrible scourge in sections of the United States, causing many thousands of deaths. It was so dreaded that when an epidemic occurred great numbers of people would desert the stricken area, fleeing until stopped, often by men with shotguns, at the borders of districts still free from the disease.

According to historical records, yellow fever made its first appearance in North America in the year 1668, when there were severe epidemics in New York and Philadelphia. During the early history of the United States yellow fever epidemics were recorded from New Hampshire to Florida, as far west as Texas, and up the Mississippi River as far as St. Louis. Between the years 1668 and 1821 there were no less than 20 different epidemics in Philadelphia, 15 in New York, 8 in Boston, and 7 in Baltimore.

An account of early epidemics in this country will be found in Dr. LaRoche's book on yellow fever published in Philadelphia in 1855. In speaking of the epidemic of 1793 in Philadelphia, when there were over 4,000 deaths, the author describes the terror which seized the population when the existence of yellow fever in the city was officially announced. People either fled to the country or shut themselves up in their homes. Friends avoided meeting in the streets, and handshaking fell into disuse. Unemployment was universal, and business came to a standstill. The death rate was so high that burying parties worked day and night disposing of the dead. During the 10 years following this epidemic there were 4 more outbreaks in Philadelphia claiming an additional 10,000 lives.

While the northern cities were visited by epidemics of yellow fever at relatively infrequent intervals, in some of the southern towns the infection was present almost continuously. In Charleston, S. C., deaths from yellow fever occurred practically every year in the nineteenth century. There were frequent and violent epidemics in Galveston, New Orleans, and a number of other Gulf ports. From New Orleans the infection was frequently carried inland along the Mississippi River. The last epidemic of yellow fever in the United States occurred in New Orleans in 1905, at which time there were cases also in Pensacola, Fla.

Yellow fever is still widespread in the interior of South America and in West Africa. Some authorities are inclined to believe that it was originally brought to the New World from West Africa on slave ships.

THE COURSE OF YELLOW FEVER IN MAN

Yellow fever derives its name from the jaundiced or yellow color of the skin, mucous membranes, and sclerae, which commonly develops about the third or fourth day of illness. The onset is usually very sudden, and patients frequently remember the exact hour when they were taken ill. The disease begins with a severe headache, backache, and fever. From the very beginning the patient feels extremely sick and prostrated. There is frequent vomiting. After the first 2 or 3 days the vomit often contains altered blood, hence the common name "black vomit." Yellow fever is a disease of rather short duration, and at the end of 1 week most victims are either dead or on their way to recovery. In fatal cases death usually occurs between the fifth and eighth day of illness. If the patient survives until the seventh day, his chances for recovery are generally good. There are exceptions to this statement, of course. In fulminating cases death may occur as early as the end of the third day, and in less severe cases as late as the ninth or tenth day. Before death the patient usually falls into a coma which may last from 12 to 24 hours. The death rate varies in different epidemics, but generally it is high in comparison with other infectious diseases.

The diagnosis of yellow fever during the first few days of illness is very difficult and almost impossible without laboratory aid. The most important early symptoms for diagnosis are high fever with slow pulse rate, leucopenia, and albuminuria; and later, jaundice, bleeding gums, and vomiting of altered blood.

There is no specific treatment for yellow fever. The best that can be done is to keep the patient quiet in bed and on light liquid diet, as in other severe illnesses.

One attack confers lifelong immunity. In places where the disease has occurred year after year, practically all the adult population has had the infection and thus is immune, so children and newcomers are the chief victims. In some persons the attack is so mild that it can be diagnosed only after recovery by testing the patient's blood for immunity.

ETIOLOGY AND MODE OF TRANSMISSION

The infectious nature of yellow fever was known long ago; but our knowledge regarding the causative agent and its mode of transmission from one person to another is quite recent, dating from the close of the Spanish-American War, when the United States Army Commission under Major Walter Reed demonstrated in Cuba that yellow fever is transmitted by a mosquito formerly called the stegomyia but now known under the scientific name of *Aëdes aegypti* and popularly designated as the aegypti. The Commission showed also that the causative

agent was present in the patient's blood during the first 3 days of illness, and that it was small enough to pass through filters which held back ordinary bacteria. In addition, the Commission demonstrated that the patient's sputum, feces, urine, and vomitus were noninfectious, and that the disease could not be contracted by contact or from contaminated objects.

Major (later General) W. C. Gorgas, who was the Chief Sanitary Officer of the United States Army of Occupation in Cuba at the time, made quick use of this knowledge. Cuba, and especially the city of Havana, had long been a notorious hotbed of yellow fever, and there were many deaths among the American soldiers stationed there. All ordinary sanitary measures had met with complete failure. Early in 1901 Gorgas introduced vigorous antimosquito measures in Havana, and as a result yellow fever disappeared as if by magic. Three years later Gorgas, by applying similar measures in the Panama Canal Zone, made possible the building of the Panama Canal.

Although the brilliant work of Major Reed and General Gorgas provided measures for preventing the spread of yellow fever, information on many important points regarding this disease was not forthcoming until much later. The chief reason for this delay was the lack of a susceptible animal in which the infection could be studied experimentally. It was only in 1927, or 27 years after Major Reed's work, that the members of the West African Yellow Fever Commission of the Rockefeller Foundation first succeeded in transmitting yellow fever to rhesus monkeys, and most of our knowledge regarding the causative agent of yellow fever has been obtained since that date. Later other animals, especially white mice and European hedgehogs, were also found to be susceptible.

We know now that the causative agent of yellow fever belongs to that class of infectious agents known as filterable viruses. It readily passes through bacteria-tight porcelain filters and is not visible even with the most powerful microscope; in fact, it is one of the smallest viruses known. It is a strict parasite in the sense that it will not multiply in the absence of living tissue cells. Outside a living host it dies out very rapidly unless special precautions are taken. It can be maintained, however, in tissue cultures as long as the tissue cells continue to live. By frequently replacing old tissues by fresh ones in such cultures, it has been possible to cultivate yellow fever virus outside a living host continuously for a number of years. Investigators noticed that in the course of prolonged cultivation under such artificial conditions the virus lost much of its virulence, and when injected into susceptible animals, such as monkeys, it produced immunity but not disease. At present such a modified virus is used for human vaccination against yellow fever on a large scale.

Before an effective vaccine was developed by the staff of the International Health Division of the Rockefeller Foundation in 1931, a number of scientists engaged in studying yellow fever in various laboratories during the 4 years between 1927 and 1931 contracted the infection accidentally, and several paid with their lives. Among the latter were Drs. Adrian Stokes, Hideyo Noguchi, William A. Young, Paul Lewis, and Theodore Hayne, whose untimely deaths were a great loss to medical science. Vaccination was introduced in May 1931, and since then there has not been a single accidental infection among the investigators.

The mechanism by which the mosquito transmits yellow fever is as follows: The virus is present in the circulating blood of an infected person, not only during the first 3 or 4 days of illness, but also at least 6 hours, and probably even longer, before the onset of fever, when the patient is still feeling perfectly well. An aegypti mosquito biting a person in this stage probably ingests several thousand infective doses of virus with its normal blood meal. The mosquito then becomes a virus carrier for the rest of its life. After the infective meal about 12 days elapse before the virus reaches the salivary glands of the mosquito. But after it has reached there, the mosquito will inject some of the virus into each subject it bites. The virus causes no harm to the mosquito itself. Although the duration of its normal life in nature is not definitely known, a mosquito infected with yellow fever virus has been kept alive in the laboratory for over 200 days.

After a susceptible person has been bitten by an infected mosquito, there follows an incubation period during which the virus multiplies in the person's body. During this period, which is usually from 3 to 5 days, but in rare instances may be as long as 10, he is feeling perfectly normal and is entirely unaware that he is carrying dangerous infection within himself. Mosquitoes that bite him toward the end of this period or during the first 3 or 4 days of illness will in turn become virus carriers, and after about 12 days they will be ready to infect new victims. In this manner the infection can persist in a community indefinitely if there are enough mosquitoes and a sufficient number of nonimmune human beings.

EPIDEMIOLOGY OF YELLOW FEVER

Yellow fever is best known as the aegypti-borne disease of cities, but it exists also in tropical forests in the absence of this mosquito and is then called "jungle yellow fever." This jungle yellow fever is primarily a disease of lower animals and is only accidentally transmitted to man. Its permanent home is in tropical forests of the interior of South America, and it is probable that the disease has a similar epidemiology in parts of Africa. Exactly what animals

serve as its host in these jungles is not yet known. We do know, however, that persons visiting jungles known to be infected contract the disease, probably from a bite of some bloodsucking insect. The yellow fever contracted in the jungle differs in no essentials from that occurring in aegypti-infected cities. Moreover, a person infected in the jungle entering a community where there is heavy aegypti breeding may serve as a source of infection for the mosquitoes and initiate an epidemic of yellow fever of the classical urban type.

There are other mosquitoes besides aegypti capable of transmitting yellow fever. Most of these are found only in tropical countries, especially Africa and South America. They have not acquired domestic habits like aegypti and generally do not breed in and around human habitations. These wild jungle mosquitoes seldom come into contact with man and therefore they play an insignificant role in the spread of yellow fever in the cities, although it would seem likely that they may serve as a source of infection contracted in the jungle.

The chief yellow fever vector, the aegypti, is, on the other hand, distinctly domestic in its habits. It breeds almost exclusively in and around houses. Its favorite breeding places are artificial water containers such as cisterns, tanks, buckets, roof gutters, and empty cans and bottles which have been filled with water during rain. In houses it often breeds in flower vases, icebox drainage pans, and other vessels in which water is left standing for some length of time. It has practically never been found breeding in swamps, rivers, lakes, or other places where malaria mosquitoes usually breed. In cities with a modern pipe-borne water supply and a sanitary sewage disposal system the number of available breeding places is limited and relatively easy to control. However, in regions where yellow fever is still prevalent most towns lack such modern facilities.

The yellow fever mosquito breeds only in a warm climate, and this explains why yellow fever epidemics have been more frequent in the southern States than in the northern. On the other hand, as shown by the occurrence of epidemics in Philadelphia, New York, and Boston, it can also breed during the summer months in the northern latitudes if introduced from the Tropics and furnished with suitable breeding places. In the Tropics it breeds in abundance and constitutes one of the major pests.

In the days of the old sailing ships drinking water on these vessels was stored in open wooden tanks which afforded excellent breeding places for aegypti mosquitoes. These vessels were the chief carriers of yellow fever infection from one port to another. This also explains why yellow fever epidemics occurred most frequently in seaports and cities on important maritime trade routes. In modern steamships the water supply is carried in closed steel tanks where mosquito breeding is impossible. But the faster modern ships and airplanes

afford easier transportation not only for infected persons but also for adult mosquitoes.

Three elements are essential for the outbreak of yellow fever in an urban community. They are an infected person, mosquitoes, and a nonimmune population. If the aegypti-infested towns are within a reasonable traveling distance from areas where jungle yellow fever is prevalent, there is always the threat that sooner or later some person will contract the infection in the jungle and unknowingly bring it into the town. Towns which previously were several days away from a jungle by mule are now only a few hours away by motor bus. The danger of a town becoming infected from the jungle increases as modern transportation facilities improve.

PREVENTION AND CONTROL OF YELLOW FEVER

Inasmuch as it is not yet known what animals and insects play a part in maintaining yellow fever in the jungle, there is very little we can do to prevent the spread of the infection in the forest itself. Certain measures can be taken, however, to prevent human beings from contracting the disease in the forest and bringing it to communities where there are conditions favorable for its spread. Most effective of these measures is vaccination against yellow fever. A person actively immunized will not be able to harbor the virus even if he should come into contact with it in the jungle. Because of this it is strongly urged that in regions where there is reason to suspect the presence of jungle yellow fever all those likely to come into contact with it in the forest be vaccinated. This applies especially to labor forces engaged in road building, forest clearing for new industrial or agricultural developments, or cutting firewood.

Although it is important to protect individuals exposed to infection in the jungle, it is of far greater importance to protect all large urban population centers and render them noninfectible, on the chance that the infection might accidentally be brought in. The most effective way to accomplish this is to rid the community of the transmitting agent—the aegypti mosquito. Without means of transmission yellow fever cannot spread. In order to devise effective measures for the eradication of the aegypti it is necessary to know something of its life and habits.

As mentioned above, the aegypti breeds only in and around houses and is found in artificial containers almost exclusively. Only females bite, and blood is essential for the development of their ova. They lay their eggs near the surface of water on the side of any container they find, but in general prefer clean water and practically never breed in sump pits or sewer drains. If the eggs remain moist, they will hatch out in about 24 to 48 hours. If, however, they become dry, hatching will be retarded, but the eggs remain viable and will

hatch if submerged in water even months later. The larvae continue to grow for 7 to 9 days until they reach the pupal stage. From the pupae the adult mosquitoes emerge about 2 days later. Thus in a very warm, tropical climate at least 10 days are required before the mosquito reaches the adult stage from the egg, and during this period it lives only in water. In cooler climates the time required to reach maturity is several days longer.

It is the aquatic stage in the cycle of development of the mosquito that is most susceptible to control measures. If all water containers are completely emptied at least once a week, the cycle is broken, and this simple procedure is sufficient to prevent mosquitoes from reproducing. As a matter of fact, this is the procedure generally employed in the control of urban yellow fever and, if carried out carefully, it usually gives excellent results.

Departments of public health are ordinarily responsible for the enforcement of antimosquito measures aimed at yellow fever. Methods have been brought to a high degree of perfection in Brazilian cities. Specially trained sanitary inspectors visit all houses at weekly intervals. Householders are instructed to keep their premises clean and to dispose of all unnecessary water containers. Water storage tanks are mosquitoproofed with wire screen. Courtyards and surroundings of houses are kept clean, and all discarded receptacles, such as empty tin cans, broken bottles, and the like, which are likely to hold rain water, are disposed of. Householders are requested to cooperate in every way with the sanitary inspectors in their effort to eradicate mosquito breeding. Those who fail to do so are sometimes fined or even more severely punished. In large cities it is at times exceedingly difficult to locate all breeding places; therefore, special skill and previous experience on the part of the inspector is essential. If antimosquito measures as outlined above are successfully introduced in an aegypti-infested community, the adult mosquitoes, as a rule, disappear within a month. If adult aegypti continue to be found in some particular houses, this indicates that there is an undiscovered breeding focus somewhere in the vicinity. Some breeding places which cannot be entirely eliminated are rendered harmless by periodical oiling, as the film of oil will kill the mosquito larvae. Large tanks are sometimes stocked with special varieties of small fish that feed on mosquito larvae.

When a case of yellow fever is discovered in an aegypti-infested town, the patient is isolated in mosquitoproof quarters to prevent mosquitoes from biting him and becoming virus carriers. As an added precaution, the house in which he was taken ill is usually fumigated for the purpose of destroying adult mosquitoes that may already have bitten him and become infected. Strict antilarval measures are imme-

diately introduced throughout the community, and mosquito breeding is thus brought under control.

During recent years rigid antimosquito measures have been enforced in many of the seaports of South and Central America and the West Indies. As a result, no serious epidemics of urban yellow fever have occurred since 1928 and 1929, when there was an outbreak in Rio de Janeiro. Although there have been many cases of jungle yellow fever in the interior of South America every year, strict antimosquito measures have prevented the spread of the infection to coastal cities. However, as long as the immense tropical hinterland of the southern continent continues to serve as a potential source of infection, the danger of its spread will persist. During periods of war or earthquake the rigid systematic control measures are likely to break down, and as soon as this happens seaports again become infested with aegypti mosquitoes and yellow fever epidemics reappear.

This situation constitutes a grave danger to all infectible countries, including the warmer regions of the United States. That our southern cities are still infectible is shown by the recent epidemics of dengue fever, a disease transmitted from one person to another by the same mosquito that transmits yellow fever, *Aëdes aegypti*. Until a few years ago travel between South America and the United States was possible only by steamship. Because of great distances and the slowness of the ship, the voyage usually took many days or even weeks. If a ship happened to carry infection, it was usually detected during the voyage. Appropriate quarantine measures were taken when a United States port was reached, and the spread of infection was prevented. Ships coming from known infected ports were invariably quarantined. The effectiveness of these measures is suggested by the fact that there has been no yellow fever in the United States since 1905.

With the development of air transportation the situation has changed greatly. Thousands of persons now travel by air every year between the United States and South America. It is thus possible for a person bitten by an infected mosquito in South America to arrive in the United States by airplane and to travel around in this country for 2 or 3 days before actually becoming ill with yellow fever acquired in distant Tropics. In the first days of his illness, and before it is possible to diagnose his infection definitely, he is capable of infecting large numbers of aegypti mosquitoes, provided these insects are present in his community. He may thus serve as a source for an epidemic outbreak of yellow fever. Moreover, there is a possibility that infected adult mosquitoes may be trapped in the airplane and be carried mechanically from one country to another.

The responsibility for preventing the introduction of yellow fever into the United States rests with the officers of the United States

Public Health Service who are constantly on guard at the various quarantine stations. When a vessel arrives from a port known or suspected to be infected with yellow fever, all on board are examined and the vessel is inspected to determine whether it is free from mosquitoes. Airplanes are likewise examined and often sprayed with insecticides to kill mosquitoes. Persons arriving by water or air from localities known to be infected, who are not in possession of vaccination certificates, are held under surveillance for the remainder of the yellow fever incubation period, counting from the time of the last possible exposure to infection. The flying personnel of the air lines operating between the United States and the various South American countries are vaccinated against yellow fever.

As a further measure of prevention, all those who expect to travel in regions where yellow fever is prevalent are urged to be vaccinated against this disease. Vaccination is now applied on a large scale in places where there is danger of infection. In 1938 more than one million persons were vaccinated in Brazil alone. In the United States a supply of vaccine is kept ready for use bv the quarantine officers at the South American air-line terminals in Miami, Fla., and Brownsville, Tex.

Unfortunately, yellow fever vaccine cannot be made available for general distribution. It was mentioned above that the vaccine consists of yellow fever virus rendered nonvirulent by prolonged cultivation in tissue cultures. But in order to produce immunity, the virus in the vaccine must be in a living or active state, since dead or inactive virus will not immunize. Yellow fever virus is very labile, and outside an animal or insect host it rapidly becomes inactivated. It can be rendered much more stable, however, if the virus-containing material or vaccine is thoroughly desiccated in the frozen state and kept in the icebox. Even when stored at low temperature, however, the vaccine becomes inactivated at a rate which is often unpredictable, and, therefore, it has been necessary to test its activity in susceptible animals every time it is used for human immunization. Testing of vaccine activity in animals requires special laboratory facilities which practicing physicians and others who occasionally might wish to use the vaccine for human immunization generally do not have at their disposal. For this reason the availability of yellow fever vaccine in the United States has been limited to certain centers where its application can be controlled scientifically. For the present the vaccine is available under certain conditions and without charge at the Laboratories of the International Health Division of the Rockefeller Foundation in New York, where it was first developed. It is also being given in Rio de Janeiro, Bogotá, London, and Paris. In recent years, missionary, commercial, and governmental organizations, whose employees are stationed in regions of tropical Africa or South America

where there is danger of yellow fever infection, have made extensive use of these facilities.

NOTES ON A VARIATION IN THE EGGS OF *ANOPHELES PUNCTIPENNIS* SAY

By WILLIAM K. LAWLOR, *Junior Entomologist, United States Public Health Service*

During the routine examination of batches of eggs laid by captive *Anopheles punctipennis* adults some unusual eggs were encountered. These eggs were so strikingly different from the ordinary or usual type of *punctipennis* eggs that they were at once noticed. In reporting them as a possible seasonal variation it is hoped that other investigators may extend and confirm these observations.

In the study of anopheline eggs the terminology used by Howard, Dyar, and Knab (1912, as corrected) and by Christophers and Barraud (1931), and other writers is followed. The *dorsal surface* of the egg is the upper surface, as the egg floats normally on the water. The *ventral surface* is the underside covered almost, if not entirely, by the water and this surface is clothed with a delicate membrane, the *exochorion*, which gives the ventral surface its silvery appearance. The *anterior end* is the larger and more blunt end. The *frill*, a delicately lobate, ribbon-like membrane around the borders of the exposed portion of the dorsal surface of the egg, is sometimes difficult to see unless lighting is properly applied. The *floats* are specialized portions of the exochorion and occur one on each side of the egg, and are composed of several compartments or cells. The *endochorion* (or *chorion* of some authors) lies beneath the exochorion.

Eggs were obtained by allowing individual wild-caught female mosquitoes to oviposit directly on the surface of water in small crystallizing dishes (50 mm. diameter) beneath "Sport" type lantern chimneys. Only one mosquito was placed in each chimney. To prevent eggs from becoming stranded on the sides of the dish, a small paraffin-coated cork ring was floated on the water.

For study, eggs were placed on wet filter paper on an ordinary microscope slide without cover glass, where they remained motionless. Both transmitted and reflected light played an important part in proper illumination. Eggs to be preserved for future use were placed on filter paper wet with 4-percent formalin and enclosed in tightly stoppered glass vials. It was found that 2-percent formalin did not entirely prevent hatching. Handling of individual eggs was most successfully accomplished by means of straight, fine-pointed dissecting forceps, using one arm of the forceps only and never closing them.

Photographs were made with a 10–X apochromatic objective, 7.5–X ocular, and a photomicrographic camera whose film holder was

10 inches from the eye point of the microscope For photography, a "hanging drop" slide, without cover glass, was found most satisfactory, the eggs being floated on a drop of water or formalin A surface illuminator attached to the microscope gave most satisfactory results as a light source.

In the literature there apparently has been no reference to a seasonal variation in *Anopheles punctipennis* eggs, such as has been noted in *A. walkeri* (figs. 1 and 2) by Matheson and Hurlbut (1937), nor any variation from the usual, such as the egg described here. The description of the egg of *punctipennis* given by Howard, Dyar, and Knab (1917) does not mention the most obvious feature of these possibly seasonal eggs (or "unusual" type, as the writer has designated them for the purposes of this note), namely, the continuation of the exochorion dorsally until it almost completely covers the "deck" or dorsal surface of the egg (fig. 3). The picture of the egg of this species given by the above authors (1912, fig 694) is distinctly that of the "usual" type of *A. punctipennis* egg and corresponds with their text description previously cited Herms and Freeborn (1920) describe, and Herms and Frost (1932) describe and illustrate the egg of *punctipennis* as encountered in California. While their description and figures do not correspond exactly with the "usual" type of egg found in Georgia, they more nearly resemble the "usual" type egg than they do the "unusual" type. There are several differences, such as total length, frill, float length, and the number of float compartments, between the "usual" type found in Georgia and the California eggs. These differences are being studied in further detail.

The first female *punctipennis* which laid the "unusual" type eggs was captured at Magnolia Springs, Jenkins County, Ga., on January 21, 1938. Another larger lot of females captured on February 3 also laid "unusual" eggs. Among these females captured on February 3 was one which laid the "usual" type of eggs. This female was indistinguishable in appearance from the others of the lot. Subsequent to February 3 several other adult females captured at Magnolia Springs laid "unusual" eggs. The observations could not be carried on throughout the year. However, it was noted that as summer approached the numbers of "unusual" type eggs obtained from females decreased and that there seemed to be an intergradation between the "unusual" and the "usual" type of eggs.

The character of the exochorion covering the "deck" or dorsal surface of the "unusual" *punctipennis* egg is distinctly different from that in the winter egg of *Anopheles walkeri*. In the latter species, reticulations are observed in this membrane as it covers the ventral surface of the egg and are plainly visible on the dorsal surface under the microscope (fig. 2). In *punctipennis* eggs, while these hexagonal

FIGURE 1 — *Anopheles walkeri* Theobald Summer eggs, dorsal aspect

FIGURE 2 — *Anopheles walkeri* Theobald Winter egg, dorsal aspect

FIGURE 3.—*Anopheles punctipennis* Say "Unusual" type egg (center) and "usual" type eggs, dorsal aspect Females have not been observed to oviposit both types of eggs in the same batch.

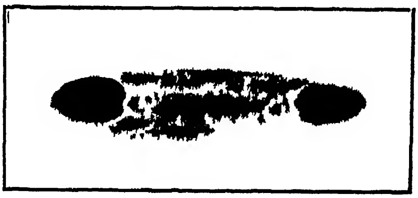

FIGURE 4.—*Anopheles punctipennis* Say. "Unusual" type egg showing extent and nonreticulated character of exochorion covering dorsal surface of the egg The two perforations near each end of the membrane were not artificially produced, but are not constant characters. Dorsal aspect.

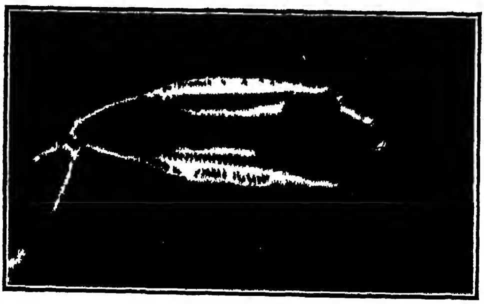

FIGURE 5.—*Anopheles punctipennis* Say. "Usual" type immediately after hatching Dorsal aspect.

reticulations are easily discernible on the ventral surface, they are barely visible on the dorsal aspect (fig. 4). Then, too, in the case of "unusual" *punctipennis* eggs the extent of the "deck" covered by the exochorion is not so great. Measurements of the two types of *punctipennis* eggs and counts of the cells of the float chambers have failed to show any significant differences, in contrast to *Anopheles walkeri*, in which the winter egg is larger than the summer egg (Matheson and Hurlbut, 1937), and apparently contains more cells in the floats. The micropylar structures of the two types of *punctipennis* eggs are apparently similar.

All of the *punctipennis* females which laid eggs during this study were the typical, clearly marked, large-spotted type. Howard, Dyar, and Knab (1917) state that the striking variation in the extent and clearness of the pale scaling on the wings found among *punctipennis* "does not even represent a local race, but merely an extreme in the ordinary line of variation." Smaller, darker specimens found in abundance at Magnolia Springs did not lay eggs in the laboratory.

SUMMARY AND CONCLUSIONS

1. Wild-caught *Anopheles punctipennis* females laid "unusual" type eggs in January and February 1938. The female mosquitoes which laid these "unusual" eggs were morphologically indistinguishable from those that had been laying "usual" type eggs during other months of the year.

2. Further studies are necessary before it can be definitely stated that the "unusual" type egg here described is a seasonal variation.

ACKNOWLEDGMENT

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THE 1940 CENSUS OF POPULATION

The sixteenth decennial census of the United States will be made in April of this year, in accordance with Constitutional provisions. The first United States census was made in 1790 by the United States marshals, and it required a year and a half to complete it, although, according to the final report to Congress, the population of the country was somewhat under 4 million. The 1940 census, covering a population estimated at 132,000,000 and including many new items of information, is expected to be completed in a month. The work will be done by 120,000 enumerators, directed by 528 district supervisors, under the direction of 105 area managers.

The general questions on population will include the name, sex, color or race, age, place of birth, residence, citizenship, education, household data, and household relationships. For persons 14 years of age and over, there are questions relating to employment status and social security. Questions regarding marriage and children will be asked of all women who are or have been married. One in 20 persons will be asked certain questions in order to secure a statistical sample for information on subjects frequently asked the Census Bureau.

Accurate population data for cities, States, and the country as a whole will be especially welcomed by health officers, vital statisticians, and others interested in health and social welfare, for use in the computation of rates; and the age distribution will serve to check the accuracy of theoretical formulae regarding a stabilized population and be useful in other ways.

The census-taking is an enormous task and deserves the full and honest cooperation of all persons in order to make the data as nearly complete and accurate as possible. It will not be a heavy burden on the individual, as many of the answers to the questions can be recorded directly by the census taker without interrogation. The Bureau of the Census states that the average person is not likely to have to answer more than half of the 33 general population questions.

COURT DECISION ON PUBLIC HEALTH

Examination for venereal disease before marriage.—(Illinois Appellate Court, First District, Third Division; *Boysen* v. *Boysen*, 23 N.E.2d 231; decided October 25, 1939.) One provision of the laws of Illinois relating to marriage was as follows:

> All persons desiring to marry shall within 15 days prior to the issuance of a license to marry, be examined by any duly licensed physician as to the existence or nonexistence in such person of any venereal disease, and it shall be unlawful for the county clerk of any court to issue a license to marry to any person who

fails to present for filing with such county clerk a certificate setting forth that such person is free from venereal disease * * *

Another statutory provision on marriage read:

That if any person residing and intending to continue to reside in this State and who is disabled or prohibited from contracting marriage under the laws of this State shall go into another State or country and there contract a marriage prohibited and declared void by the laws of this State, such marriage shall be null and void for all purposes in this State with the same effect as though such prohibited marriage had been entered into in this State.

A marriage was contracted by residents of Illinois in another State, the parties then returning to Illinois. In a suit for the annulment of the marriage the plaintiff contended that the marriage was void because contracted outside of Illinois to evade the statutory provision regarding examination for venereal disease. In passing upon the matter the appellate court quoted from a prior case, a portion of the quotation being as follows:

In Illinois, "the general rule is that unless the statute expressly declares a marriage contracted without the necessary consent of the parents, or other requirements of the statute, to be a nullity, such statutes will be construed to be directory, only, in this respect, so that the marriage will be held valid although disobedience of the statute may entail penalties on the licensing or officiating authorities." * * *

Neither the statutes of Illinois nor Missouri declare that marriages under a certain age without the parents' consent are void. The provisions fixing the age of consent, requiring the consent of the parents and imposing penalties on the clerk for issuing a license and on officers for celebrating a marriage in violation of the provisions of the statute, are only directory and not prohibitive. * * *

Proceeding, the court used this language:

This court in passing upon the question involved in that case said as to a marriage contracted in a foreign State which does not comply with the requirements of the statute of this State, where the marriage is not declared null and void, that, by this particular statute, the direction of the clerk to issue a license is directory only and not prohibitive. This applies to the facts as we find them in the record in this case, for the venereal disease act does not declare that a marriage celebrated without complying with that statute shall be null and void.

A provision of the statute relating to marriage and the existence or nonexistence in such person of any venereal disease is that it shall be unlawful for the county clerk of any court to issue a license to marry to any person who fails to present for filing a certificate such as is required by the act, and is the only prohibitive clause in the act. * * *

Therefore since the laws of Illinois did not declare void a marriage entered into without compliance with the above-quoted statutory provision as to examination for and freedom from venereal disease, the appellate court rejected the plaintiff's contention that the marriage in the instant case was void.

The order of the lower court, which was adverse to the plaintiff, was affirmed.

DEATHS DURING WEEK ENDED FEBRUARY 10, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Feb. 10, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	10,049	9,668
Average for 3 prior years	9,718	
Total deaths, first 6 weeks of year	58,190	55,505
Deaths under 1 year of age	541	574
Average for 3 prior years	582	
Deaths under 1 year of age, first 6 weeks of year	3,307	3,264
Data from industrial insurance companies:		
Policies in force	66,294,279	68,102,528
Number of death claims	13,689	14,277
Death claims per 1,000 policies in force, annual rate	10.8	10.9
Death claims per 1,000 policies, first 6 weeks of year, annual rate	10.5	10.2

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease withou knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 24, 1940

Summary

The number of influenza cases reported by the State health officers dropped from 16,548 for the preceding week to 13,950 for the week ended February 24. The preponderance of cases is still being reported from the South Atlantic and South Central States. For the current week, however, all but 3 of the 9 geographic areas registered decreases The two South Central groups reported considerable decreases, while the South Atlantic States reported an increase, almost entirely accounted for by the rise in the number of cases in West Virginia from 954 to 1,733. All other States in this group reported a decrease, except South Carolina and Virginia, where conditions remained about the same as in the preceding week.

The rise of influenza above the 5-year median began during the week of October 14, 1939, and the numbers of cases reported weekly have remained above the median since that date. The incidence by weeks since the first of the year is as follows:

January				February			
6	13	20	27	3	10	17	24
9, 630	12, 516	12, 568	13, 242	17, 641	16, 583	16, 548	13, 950

The current incidence of the other 8 communicable diseases included in the weekly telegraphic reports remained below the median expectancy, with the exception of poliomyelitis, which increased from 27 to 30 cases, as compared with the preceding week, while the 5-year median expectancy is 18. Wisconsin reported 5 cases, the highest number for any State.

Telegraphic morbidity reports from State health officers for the week ended February 24, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria: Week ended Feb. 24, 1940	Diphtheria: Week ended Feb. 25, 1939	Diphtheria: Median, 1935–39	Influenza: Week ended Feb. 24, 1940	Influenza: Week ended Feb. 25, 1939	Influenza: Median, 1935–39	Measles: Week ended Feb. 24, 1940	Measles: Week ended Feb. 25, 1939	Measles: Median, 1935–39	Meningitis, meningococcus: Week ended Feb. 24, 1940	Meningitis, meningococcus: Week ended Feb. 25, 1939	Meningitis, meningococcus: Median, 1935–39
NEW ENG.												
Maine	0	4	1	....	25	5	214	14	44	0	0	0
New Hampshire	0	0	0	....	....	....	49	0	23	0	0	0
Vermont	0	0	0	....	....	....	5	2	4	0	0	0
Massachusetts	4	4	4	....	....	....	292	1,041	400	1	1	2
Rhode Island	0	0	0	....	....	....	111	15	32	0	2	2
Connecticut	0	4	3	2	29	12	185	464	464	0	0	1
MID. ATL.												
New York	25	31	31	[1] 44	[1] 101	[1] 45	319	1,625	1,625	1	5	8
New Jersey	8	10	12	42	44	24	87	25	574	1	0	1
Pennsylvania	25	41	45	....	....	....	98	113	616	11	5	6
E. NO. CEN.												
Ohio	22	17	36	32	....	53	11	41	108	0	1	8
Indiana	13	13	20	66	1,085	71	5	8	11	0	0	2
Illinois	29	23	31	61	1,478	64	37	19	36	2	2	7
Michigan [3]	7	22	15	....	255	4	228	447	447	0	0	2
Wisconsin	1	3	3	183	346	134	312	1,065	1,065	0	1	1
W. NO. CEN.												
Minnesota	0	4	4	7	24	1	291	1,246	168	2	0	0
Iowa	4	5	2	42	291	14	158	159	66	1	0	2
Missouri	10	8	23	42	....	393	3	9	25	0	2	3
North Dakota	3	1	1	23	64	10	3	141	3	0	1	0
South Dakota	0	4	1	1	6	4	2	200	1	0	0	0
Nebraska	1	4	6	....	....	....	29	82	40	2	0	1
Kansas	10	7	9	78	77	22	417	20	20	3	0	0
SO. ATL.												
Delaware	0	2	0	....	....	....	1	0	21	0	0	0
Maryland [2]	0	4	5	107	209	69	4	1,153	136	0	1	7
Dist. of Col.	5	7	10	8	25	7	2	19	11	0	2	2
Virginia	18	17	17	2,430	1,604	....	27	223	269	4	2	6
West Virginia [3]	8	10	10	1,733	36	131	13	49	49	1	3	3
North Carolina [3]	10	22	23	64	230	216	124	1,430	765	0	1	3
South Carolina	5	4	4	1,182	592	604	16	34	34	1	0	2
Georgia [3]	8	5	8	385	110	356	197	232	0	2	1	1
Florida [3]	6	5	7	38	....	35	65	138	40	0	0	1
E. SO. CEN.												
Kentucky	10	9	9	115	405	405	44	42	243	2	3	9
Tennessee	6	7	12	307	83	246	133	34	38	1	0	8
Alabama [3]	11	13	18	699	180	1,189	44	258	258	1	3	3
Mississippi [2]	9	4	6	....	....	....	....	....	....	0	3	2
W. SO. CEN.												
Arkansas	7	13	11	997	182	182	3	68	60	1	0	2
Louisiana [3]	6	23	15	110	9	24	18	136	70	0	2	2
Oklahoma	8	5	7	487	193	227	7	177	50	0	1	1
Texas [3]	44	35	38	3,448	737	751	414	122	267	1	0	7
MOUNTAIN												
Montana	1	2	2	8	200	132	33	444	30	0	0	0
Idaho	1	1	1	1	12	7	186	74	44	0	0	0
Wyoming	2	1	0	....	....	....	22	67	4	0	0	0
Colorado	8	8	8	35	121	....	32	95	95	0	1	1
New Mexico	1	0	3	19	3	6	1	21	23	0	0	0
Arizona	3	1	2	291	94	101	16	21	23	1	3	1
Utah	0	0	0	19	44	....	273	155	26	0	1	0
PACIFIC												
Washington	1	4	4	56	....	1	529	271	130	0	2	1
Oregon	6	2	1	37	34	143	351	28	28	0	0	0
California	28	32	34	705	59	158	408	3,047	601	3	2	5
Total	369	441	506	13,904	8,987	8,987	5,819	15,134	15,134	42	51	160
8 weeks	3,394	4,483	5,197	112,632	36,759	38,450	37,660	90,202	90,202	307	437	833

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 24, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–30	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Feb. 24, 1940	Feb. 25, 1939		Feb. 24, 1940	Feb. 25, 1939		Feb. 24, 1940	Feb. 25, 1939		Feb. 24, 1940	Feb. 25, 1939	
NEW ENG.												
Maine	0	0	0	13	38	22	0	0	0	0	1	1
New Hampshire	0	0	0	1	1	16	0	0	0	0	0	0
Vermont	0	0	0	13	5	16	0	0	0	0	0	0
Massachusetts	1	0	0	105	233	241	0	0	0	1	1	1
Rhode Island	0	0	0	20	14	17	0	0	0	0	0	0
Connecticut	0	0	0	101	100	88	0	0	0	5	0	0
MID. ATL.												
New York	0	0	0	731	721	793	0	0	0	0	5	5
New Jersey	1	0	0	367	187	174	0	0	0	0	1	1
Pennsylvania	3	0	0	597	408	511	0	0	0	5	4	4
E. NO. CEN.												
Ohio	1	0	0	210	537	493	0	31	7	5	3	3
Indiana	1	0	0	186	217	223	0	136	8	4	0	1
Illinois	1	1	1	656	401	706	6	11	11	5	3	4
Michigan [2]	0	1	0	272	585	585	0	47	3	0	8	3
Wisconsin	5	0	0	174	338	349	6	5	7	4	0	1
W. NO. CEN.												
Minnesota	0	1	0	106	118	169	6	9	9	0	0	0
Iowa	1	0	0	102	159	178	9	34	34	7	1	1
Missouri	0	2	0	87	0	213	12	4	5	0	6	1
North Dakota	0	0	0	50	27	46	1	6	10	1	1	0
South Dakota	0	0	0	22	15	17	0	1	5	0	0	0
Nebraska	0	0	0	21	47	94	0	8	8	0	0	0
Kansas	2	0	0	82	132	209	0	9	9	2	0	0
SO. ATL.												
Delaware	0	0	0	13	0	6	0	0	0	0	0	0
Maryland [3]	0	0	0	43	53	62	0	0	0	0	0	1
Dist. of Col	0	0	0	25	20	20	0	0	0	0	1	1
Virginia	2	2	0	50	33	35	0	0	0	0	2	2
West Virginia [3]	2	0	0	56	51	51	0	0	0	2	5	4
North Carolina [3]	1	0	0	36	56	33	0	0	0	0	4	4
South Carolina	0	0	0	2	5	5	0	0	0	3	2	2
Georgia [3]	1	1	0	19	2	13	1	0	0	2	2	2
Florida [3]	0	1	1	4	10	6	0	0	0	2	1	1
E. SO. CEN.												
Kentucky	0	1	0	84	74	74	0	7	0	4	3	3
Tennessee	0	0	0	86	39	39	0	3	0	1	2	2
Alabama [3]	0	3	2	23	10	12	0	6	1	2	2	2
Mississippi [3]	2	0	0	10	7	12	0	1	1	1	1	1
W. SO. CEN.												
Arkansas	0	1	0	14	17	11	0	5	5	2	0	1
Louisiana [3]	0	0	0	12	16	14	0	0	0	7	46	7
Oklahoma	0	0	0	12	49	31	1	22	6	0	0	0
Texas [3]	3	1	1	53	87	87	4	25	2	5	6	11
MOUNTAIN												
Montana	0	0	0	33	56	47	0	3	11	0	1	1
Idaho	0	0	0	14	9	19	0	4	4	0	0	0
Wyoming	0	0	0	6	13	13	0	1	3	0	0	0
Colorado	0	0	0	81	33	73	17	17	5	0	0	0
New Mexico	0	1	0	13	11	24	1	1	0	1	0	0
Arizona	0	0	0	4	15	16	0	20	0	1	0	0
Utah	0	1	0	26	37	49	0	0	0	0	0	0

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended February 24, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	Feb. 24, 1940	Feb. 25, 1939		Feb. 24, 1940	Feb. 25, 1939		Feb. 24, 1940	Feb. 25, 1939		Feb. 24, 1940	Feb. 25, 1939	
PACIFIC												
Washington	0	1	0	66	53	57	1	5	23	0	1	1
Oregon	0	0	0	24	45	58	0	4	4	2	0	0
California	3	0	1	156	256	242	0	26	9	4	2	4
Total	30	18	18	4,911	5,430	6,901	65	451	283	78	115	113
8 weeks	260	133	174	35,765	42,750	50,571	573	3,201	2,364	621	891	891

Division and State	Whooping cough	
	Week ended	
	Feb. 24, 1940	Feb. 25, 1939
NEW ENG.		
Maine	49	11
New Hampshire	6	1
Vermont	23	19
Massachusetts	124	225
Rhode Island	12	85
Connecticut	27	65
MID. ATL.		
New York	354	568
New Jersey	55	440
Pennsylvania	267	365
E. NO. CEN.		
Ohio	67	213
Indiana	24	26
Illinois	105	278
Michigan [2]	100	225
Wisconsin	97	318
W. NO. CEN.		
Minnesota	19	42
Iowa	9	24
Missouri	11	32
North Dakota	7	10
South Dakota	0	0
Nebraska	12	8
Kansas	39	32
SO. ATL.		
Delaware	4	10
Maryland [2]	153	20
Dist. of Col.	24	17
Virginia	54	65
West Virginia [2]	43	22

Division and State	Whooping cough	
	Week ended	
	Feb. 24, 1940	Feb. 25, 1939
SO. ATL.—continued		
North Carolina [3]	65	266
South Carolina	14	75
Georgia [3]	23	54
Florida [3]	8	25
E. SO. CEN.		
Kentucky	47	23
Tennessee	32	14
Alabama [3]	19	45
Mississippi [2]	---	---
W. SO. CEN.		
Arkansas	10	8
Louisiana [3]	30	12
Oklahoma	1	2
Texas [3]	111	64
MOUNTAIN		
Montana	4	15
Idaho	44	2
Wyoming	6	12
Colorado	3	44
New Mexico	23	20
Arizona	23	36
Utah	100	22
PACIFIC		
Washington	26	37
Oregon	36	12
California	198	116
Total	2,508	4,025
8 weeks	22,093	34,185

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended February 24, 1940, 25 cases as follows: North Carolina, 1; Georgia, 4; Florida, 1; Alabama, 5; Louisiana, 3; Texas, 11.

CASES OF VENEREAL DISEASES REPORTED FOR DECEMBER 1939

These reports are published monthly for the information of health officers in order to furnish current data as to the prevalence of the venereal diseases. The figures are taken from reports received from State and city health officers. They are preliminary and are therefore subject to correction. It is hoped that the publication of these reports will stimulate more complete reporting of these diseases.

Reports from States

	Syphilis		Gonorrhea	
	Cases reported during month	Monthly case rates per 10,000 population	Cases reported during month	Monthly case rates per 10,000 population
Alabama [1]				
Arizona	221	5.29	102	2.44
Arkansas	891	4.29	180	.87
California	1,579	2.53	1,378	2.20
Colorado	97	.90	61	.57
Connecticut	181	1.03	123	.70
Delaware	203	7.72	25	.95
Dist. of Columbia	659	10.36	325	5.11
Florida	2,413	14.20	204	1.20
Georgia	1,404	4.51	71	.23
Idaho	34	.68	10	.20
Illinois	1,976	2.50	1,090	1.38
Indiana	490	1.40	142	.41
Iowa	277	1.08	122	.48
Kansas	244	1.31	129	.69
Kentucky	615	2.08	223	.75
Louisiana	483	2.25	97	.45
Maine	39	.45	32	.37
Maryland	795	4.72	265	1.57
Massachusetts	433	.98	335	.76
Michigan	709	1.45	359	.74
Minnesota	224	.84	177	.66
Mississippi	1,808	8.86	2,418	11.85
Missouri	694	1.73	193	.48
Montana	47	.86	28	.51
Nebraska	110	.81	61	.45
Nevada	30	2.94	20	1.96
New Hampshire	16	.31	5	.10
New Jersey	851	1.95	228	.52
New Mexico	135	3.20	60	1.42
New York	3,360	2.59	1,448	1.11
North Carolina	1,871	5.30	187	.53
North Dakota	28	.39	42	.59
Ohio	805	1.19	287	.42
Oklahoma	377	1.47	245	.95
Oregon	115	1.11	102	98
Pennsylvania	1,072	1.05	111	.11
Rhode Island	69	1.01	25	.37
South Carolina	883	4.69	224	1.18
South Dakota	31	.45	27	.39
Tennessee	1,332	4.56	330	1.13
Texas	3,846	5.43	650	1.04
Utah	41	.79	26	.50
Vermont [1]				
Virginia	1,748	6.37	270	.98
Washington	150	.95	202	1.21
West Virginia	262	1.38	104	.55
Wisconsin	40	.14	74	.25
Wyoming	15	.63	7	.30
Total	29,463	2.62	12,298	1.01

Reports from cities of 200,000 population or over [2]

Akron, Ohio	27	.98	23	.84
Atlanta, Ga	313	10.42	68	2.26
Baltimore, Md	469	5.61	177	2.12
Birmingham, Ala	276	9.38	52	1.77
Boston, Mass	158	1.99	115	1.45
Buffalo, N. Y	74	1.23	48	.80
Chicago, Ill	1,235	3.37	742	2.02
Cincinnati, Ohio	105	2.22	68	1.44
Cleveland, Ohio	370	3.92	80	.85
Columbus, Ohio	102	3.25	15	.48
Dallas, Tex	205	6.74	96	3.16

See footnotes at end of table.

Reports from cities of 200,000 population or over—Continued

	Syphilis		Gonorrhea	
	Cases reported during month	Monthly case rates per 10,000 population	Cases reported during month	Monthly case rates per 10,000 population
Denver, Colo	67	2.22	44	1.46
Houston, Tex	185	5.16	120	3.35
Jersey City, N. J	36	1.11	10	.31
Kansas City, Mo	116	2.69	43	1.00
Los Angeles, Calif	836	5.50	583	3.83
Louisville, Ky	175	5.16	58	1.71
Memphis, Tenn	386	13.22	48	1.64
Milwaukee, Wis	2	.03	10	.16
Minneapolis, Minn	55	1.10	58	1.16
Newark, N. J	121	2.66	200	4.40
New York, N. Y	2,818	3.09	951	1.27
Oakland, Calif	60	1.92	68	2.17
Omaha, Nebr	36	1.61	28	1.25
Philadelphia, Pa	484	2.41		
Portland, Oreg	75	2.34	78	2.43
Rochester, N. Y	24	.70	52	1.52
St. Louis, Mo	64	.76	68	.81
St. Paul, Minn	37	1.29	20	.70
San Antonio, Tex	459	17.55	52	1.99
San Francisco, Calif	183	2.66	193	2.80
Seattle, Wash	84	2.17	98	2.53
Syracuse, N. Y	65	2.88	11	.49
Washington, D. C	659	10.36	325	5.11

[1] No report for current month.
[2] No reports received from Dayton, Detroit, Indianapolis, New Orleans, Pittsburgh, Providence, or Toledo.

WEEKLY REPORTS FROM CITIES

City reports for week ended February 10, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	183	1,222	147	4,682	965	2,004	36	387	18	1,138	
Current week [1]	97	1,089	119	1,210	760	1,430	5	340	14	749	
Maine:											
Portland	0		0	34	2	1	0	0	0	14	28
New Hampshire:											
Concord	0		0	0	3	0	0	0	0	0	11
Manchester	0		1	0	1	0	0	0	0	0	14
Nashua	0		0	27	0	0	0	0	0	0	7
Vermont:											
Barre	0			0		0	0		0	0	
Burlington	0		0	0	0	0	0	0	0	0	10
Rutland	0		0	0	0	0	0	0	0	0	5
Massachusetts:											
Boston	1		2	18	7	46	0	4	0	46	235
Fall River	0		0	23	1	0	0	1	0	23	30
Springfield	0		0	1	3	5	0	0	0	3	42
Worcester	0		0	2	15	4	0	0	0	3	73
Rhode Island:											
Pawtucket	1		0	8	0	3	0	0	0	0	22
Providence	0		0	91	7	8	0	2	0	8	72
Connecticut:											
Bridgeport	0		0	2	2	2	0	2	0	0	41
Hartford	0		0	0	2	5	0	0	1	8	42
New Haven	0		1	0	0	5	0	0	0	6	61
New York:											
Buffalo	0		0	3	6	4	0	7	0	6	116
New York	17	36		40		377	0		3	80	1,568
Rochester	0	1	1	5	3	7	0	1	0	6	65
Syracuse	0		0	0	5	7	0	1	0	12	56
New Jersey:											
Camden	2	2	2	0	3	4	0	0	0	0	47
Newark	0	4	0	14	6	25	0	3	0	25	125
Trenton	0	1	2	0	10	5	0	4	0	2	58

[1] Figures for Little Rock and for deaths in New York estimated; reports not received.

City reports for week ended February 10, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Pennsylvania:											
Philadelphia	3	41	8	4	44	53	0	28	0	0	687
Pittsburgh	2	18	9	3	23	37	0	10	0	10	257
Reading	0	------	1	1	4	0	0	0	0	2	24
Scranton	1	------	------	1	------	4	0	------	0	1	------
Ohio:											
Cincinnati	3	1	5	0	11	21	0	6	0	16	156
Cleveland	0	106	3	7	7	34	0	11	1	34	215
Columbus	0	1	1	2	6	9	0	4	0	4	114
Toledo	0	8	1	4	3	10	0	1	0	4	82
Indiana:											
Anderson	2	------	0	0	5	3	0	0	0	8	14
Fort Wayne	0	------	0	0	3	2	0	1	0	0	26
Indianapolis	6	------	1	1	13	23	2	4	1	16	132
Muncie	1	------	0	0	4	6	0	0	0	0	14
South Bend	0	------	1	0	2	4	0	0	0	0	21
Terre Haute	0	------	3	0	5	0	0	1	0	0	38
Illinois:											
Alton	0	------	0	0	3	1	0	1	0	0	11
Chicago	10	84	6	10	58	333	0	31	0	37	779
Elgin	0	------	0	1	2	1	0	0	0	2	14
Moline	0	------	1	0	1	4	0	0	0	0	16
Springfield	0	------	1	0	5	5	0	0	0	0	30
Michigan:											
Detroit	3	1	1	6	18	53	0	12	1	34	274
Flint	1	------	0	0	6	11	0	0	0	15	31
Grand Rapids	0	------	0	4	4	15	0	0	0	4	37
Wisconsin:											
Kenosha	0	------	0	1	0	2	0	0	0	0	4
Milwaukee	0	------	0	1	6	20	0	8	0	5	106
Racine	0	------	0	2	1	2	0	0	0	2	14
Superior	0	------	0	7	0	1	0	0	0	0	12
Minnesota:											
Duluth	0	------	0	300	0	2	0	1	0	0	32
Minneapolis	3	------	0	1	7	23	0	1	0	5	141
St. Paul	0	2	2	1	8	11	0	1	0	11	80
Iowa:											
Cedar Rapids	0	------	------	4	------	2	0	------	0	0	------
Davenport	0	------	------	0	------	3	0	------	0	0	------
Des Moines	0	------	0	3	0	12	0	0	0	1	40
Sioux City	0	------	------	0	------	2	0	------	0	0	------
Waterloo	2	------	------	0	------	5	0	------	0	0	------
Missouri:											
Kansas City	1	9	1	1	19	18	0	6	0	0	110
St. Joseph	0	------	0	0	5	1	0	0	0	0	31
St. Louis	5	32	5	3	30	31	2	13	0	7	252
North Dakota:											
Fargo	0	------	0	0	2	0	0	0	0	0	8
Grand Forks	0	------	------	0	------	0	0	------	0	2	------
Minot	0	------	0	0	0	1	0	0	0	0	4
South Dakota:											
Aberdeen	0	------	------	1	------	2	0	------	0	0	------
Sioux Falls	0	------	0	0	0	8	0	0	0	0	8
Nebraska:											
Lincoln	1	------	------	1	------	1	0	------	0	1	------
Omaha	0	------	0	0	6	8	0	5	0	0	51
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	10
Topeka	0	1	1	0	4	2	0	0	0	1	18
Wichita	1	2	0	233	6	3	0	1	0	0	35
Delaware:											
Wilmington	0	------	0	0	3	1	0	2	0	8	35
Maryland:											
Baltimore	2	77	2	1	27	24	0	12	0	142	306
Cumberland	0	------	0	0	5	0	0	0	0	0	28
Frederick	0	------	0	0	1	3	0	0	0	0	------
Dist. of Col.:											
Washington	0	19	5	0	29	21	0	16	1	15	226
Virginia:											
Lynchburg	1	------	0	0	3	0	0	0	0	3	19
Norfolk	1	159	0	0	5	2	0	1	0	5	30
Richmond	0	------	2	0	7	3	0	1	0	0	56
Roanoke	0	------	0	1	1	3	0	0	0	2	18
West Virginia:											
Charleston	1	2	0	0	1	0	0	0	0	0	18
Huntington	0	------	------	0	------	2	0	------	0	0	------
Wheeling	0	------	1	0	2	2	0	0	1	1	17

City reports for week ended February 10, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	1	1	0	0	0	0	7
Wilmington	0	------	2	0	2	0	0	0	0	0	21
Winston-Salem	0	2	0	0	1	8	0	0	0	0	10
South Carolina:											
Charleston	0	226	1	0	5	0	0	1	1	0	25
Florence	0	------	0	0	0	0	0	0	0	0	3
Greenville	0	------	0	0	1	0	0	0	0	1	11
Georgia:											
Atlanta	0	69	3	16	15	8	0	5	0	3	110
Brunswick	0	------	0	0	0	0	0	0	0	0	5
Savannah	0	64	2	0	6	1	0	2	0	0	38
Florida:											
Miami	0	13	0	0	7	1	0	2	1	0	60
Tampa	2	7	3	17	8	1	0	0	0	1	48
Kentucky:											
Ashland	0	------	0	0	1	0	0	0	0	2	6
Covington	0	------	0	1	2	2	0	0	0	0	18
Lexington	1	------	0	0	1	8	0	2	0	6	17
Louisville	0	26	0	3	12	34	0	5	0	30	95
Tennessee:											
Knoxville	0	16	3	0	3	16	0	1	0	0	35
Memphis	0	31	6	10	12	29	1	4	0	6	118
Nashville	0	------	3	13	5	2	0	3	0	0	66
Alabama:											
Birmingham	0	27	2	0	9	2	0	3	0	0	94
Mobile	0	11	3	0	4	2	0	1	0	0	35
Montgomery	0	4	------	7	------	0	0	------	0	0	------
Arkansas:											
Fort Smith	1	133	------	0	------	0	0	------	0	0	------
Little Rock	------	------	------	------	------	------	------	------	------	------	------
Louisiana:											
Lake Charles	1	------	0	0	1	1	0	1	0	1	4
New Orleans	9	41	6	1	39	9	0	14	1	4	238
Shreveport	0	------	2	0	22	0	0	0	0	0	60
Oklahoma:											
Oklahoma City	1	52	0	0	6	1	0	3	0	0	50
Tulsa	3	------	------	0	------	11	0	------	0	6	------
Texas:											
Dallas	6	11	3	2	8	3	0	2	0	10	73
Fort Worth	3	------	0	1	4	4	0	0	0	8	34
Galveston	1	------	0	1	4	1	0	0	0	0	22
Houston	6	2	2	3	14	3	0	2	1	4	94
San Antonio	1	48	2	59	18	1	0	7	0	3	107
Montana:											
Billings	1	------	0	0	1	0	0	0	0	0	13
Great Falls	0	------	0	0	1	2	0	0	0	0	14
Helena	0	------	0	0	0	0	0	0	0	0	3
Missoula	0	------	0	0	0	0	0	0	0	1	6
Idaho:											
Boise	0	------	0	1	*2	0	0	0	0	0	10
Colorado:											
Colorado Springs	0	------	0	0	2	1	0	0	0	0	18
Denver	8	------	1	2	10	9	0	2	0	0	106
Pueblo	2	------	0	1	0	5	0	0	0	0	11
New Mexico:											
Albuquerque	0	------	0	0	2	2	0	3	0	7	11
Utah:											
Salt Lake City	0	------	1	39	1	9	0	0	0	59	29
Washington:											
Seattle	1	------	1	136	6	8	0	5	0	3	123
Spokane	1	1	1	1	3	7	0	0	0	10	34
Tacoma	0	------	0	51	2	4	0	0	0	0	37
Oregon:											
Portland	0	8	1	58	10	9	0	3	0	9	112
Salem	0	2	------	32	------	0	0	------	0	0	------
California:											
Los Angeles	3	152	4	10	16	24	0	18	1	16	322
Sacramento	0	1	1	1	4	0	0	0	1	0	34
San Francisco	4	4	0	1	9	4	0	10	0	13	188

City reports for week ended February 10, 1940—Continued

State and city	Meningococcus meningitis		Poliomyelitis cases	State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				Maryland:			
Boston	0	0	1	Baltimore	1	1	0
Ohio:				District of Columbia:			
Cincinnati	1	0	0	Washington	1	1	0
Michigan:				Texas:			
Detroit	1	0	1	San Antonio	1	0	0
Missouri:				California:			
St. Louis	1	0	0	Los Angeles	1	0	0

Encephalitis, epidemic or lethargic.—Cases: Charleston, S. C., 1.
Pellagra.—Cases: Philadelphia, 1; Atlanta, 3; Los Angeles, 1.
Typhus fever.—Cases: Charleston, S. C., 2; Houston, Texas, 2.

FOREIGN REPORTS

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of February 23, 1940, pages 342–345. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Argentina—Salta Province—El Carril.—For the period January 16 to 31, 1940, 1 case of plague with 1 death was reported in El Carril, Salta Province, Argentina.

Azores Islands—San Miguel.—During the month of January 1940, 2 cases of plague were reported in a rural area of San Miguel, Azores Islands.

Typhus Fever

France—Basses-Alpes Department—Le Caire—Correction.—The case of typhus fever reported on page 224 of the PUBLIC HEALTH REPORTS of February 2, 1940, as occurring in Le Caire, Basses-Alpes Department, France, is an error. It should have been reported as occurring in Cairo, Egypt.

Yellow Fever

Colombia—Antioquia Department—San Luis.—On January 15, 1940, 1 death from yellow fever was reported in San Luis, Antioquia Department, Colombia.

French Equatorial Africa—Gabon.—On February 13, 1940, 1 suspected case of yellow fever was reported in Gabon, French Equatorial Africa.

X

Public Health Reports

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IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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Public Health Reports

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THE PLACE OF AN INDEX IN HEALTH DEPARTMENT RECORD KEEPING[1]

By JOSEPH W. MOUNTIN, *Assistant Surgeon General*, and EVELYN FLOOK, *United States Public Health Service*

For some time the United States Public Health Service has pursued a series of studies concerning the practices that are followed in selected small health departments serving rural counties. Among the devices found in use is a record system of conventional type, the main elements of which may be enumerated as follows: (1) The daily report, designed to provide a consecutive list of activities by workers; (2) the case record, a form which summarizes service rendered for separate conditions; (3) the family folder, a composite record of household members served by the department; and (4) the periodic report of the department to the sponsoring agencies.

The foregoing terms of common usage are not truly descriptive of actual recording and reporting practice. Departures and omissions disclosed by the study probably are no different from those which might be found in the performance of a large number of similar organizations. A few, however, may be cited for illustrative purposes. The daily report was completed with relative faithfulness by nurses, to a lesser degree by sanitation officers, and seldom or not at all by health officers. A rough check of recording practice showed that personnel tended to disregard casual and administrative contacts; hence, it is reasonable to suppose that even the entries made by nurses accounted for much less than the total service they actually rendered.

The above observations are in line with the experience of Randall[2] who, at the beginning of a survey of public health nursing services in Cattaraugus County, N. Y., found it necessary to emphasize "the importance of the nurse recording for *every* visit 'why she visited, what she did, and what happened.' " Special stress upon this procedure was necessary because prior to the survey period it had been common

[1] From the Division of Public Health Methods, National Institute of Health, in cooperation with the Division of Domestic Quarantine

[2] Randall, Marian G Public Health Nursing Service in Rural Families The Milbank Memorial Fund Quarterly Bulletin, 9 147 (October 1931).

practice not to record "single visits," "casual calls," or "inconsequential visits," which later were shown to represent all the service received by about half of the nursing clients.

In the three counties primarily under consideration, case records were used almost exclusively for persons admitted to clinic and home nursing service. Furthermore, the so-called family folder was little more than a filing device for case records opened in connection with the field nursing service. Upon tracing the origin of the monthly report, it was found to be a list of items prepared by the State health authorities for local enumeration.

After supplementing the local clerical force, the Public Health Service was able to improve the consistency of record keeping without affecting the extent or character of actual health department service. Special attention was given to the daily report in order that a complete account of all contacts made by the several professional employees might be obtained. Early in the course of the study a preliminary inspection of the data was made for the purpose of determining types of analysis that might be both feasible and revealing. An obvious defect in the prevailing record system from the standpoint of analysis, and one that immediately became apparent, was the absence of an arrangement for isolating in unduplicated form the recipient of service. Thus it was not possible to determine for individuals or situations the items of service rendered by the several staff members. The limitations which such a record keeping system places on analysis can readily be appreciated. In an effort to compensate for the deficiency referred to, a very simple index card which will be described later was devised.

A more extensive and meticulous analysis of the entire body of recorded data furnished objective and quantitative evidence which supported earlier impressions concerning the variance between service rendered and the way it was recorded. These points have been discussed in the series of papers [3] bearing on this aspect of health administration. Bean and Hankla,[4] for example, found that it was the actual practice of these health departments to enter on the appropriate case records home services for only about two-thirds of their patients seen for maternity, tuberculosis, acute communicable diseases, or health supervision. Omission of a case record for each person served

[3] (a) Bean, Helen, and Hankla, Emily: Case Records as an Index of the Public Health Nurse's Work. Pub. Health Rep., 52:1077 (August 6, 1937).

(b) Derryberry, Mayhew: Do Case Records Guide the Nursing Service? Pub. Health Rep., 54:66 (January 20, 1939).

(c) Derryberry, Mayhew: Nursing Accomplishments as Revealed by Case Records. Pub. Health Rep., 54:2035 (November 17, 1939).

(d) Dean, J. O., and Flook, Evelyn: Neglected Opportunities for Teamwork in County Health Department Practice. To be published in Public Health Reports.

(e) Mountin, Joseph W., and Flook, Evelyn: The Scope of Personal Service Given by Representative County Health Departments. The Health Officer, 4:42 (November 1939).

[4] See footnote 3 (a).

by those departments may be ascribed in part to the fact that, varying with the counties studied, between one-third and two-thirds of the nurses' clients received only one visit. Return visits were even less frequently reported by health officers and sanitation officers. Obviously, under such practice, the maximum need for case records as a guide to future service could not have been far reaching.

The findings of Derryberry [5] raise extreme doubt as to the purposeful usage of even those case records which were completed, for there was little evidence that they influenced the nurse either in selection of patients for revisiting or in deciding upon the type of service to be rendered. No consistency in selection of cases for subsequent visits was noted, either among the several areas or between workers within each separate county. An item recorded as unsatisfactory on the first visit was followed up for some persons and not for others. Furthermore, Derryberry [6] found that a substantial proportion of the items designated as unsatisfactory on the first call were given no grading whatever on subsequent visits even when a return to the case had been recorded. It is assumed that the nurse either failed to observe the condition on the repeat visit or forgot to record the change which had taken place during the interim between her calls. No matter which circumstance prevailed, the value of the record as a guide to future service was lowered by the omission which caused a break in continuity of the case history.

According to Dean and Flook,[7] the extent to which records were used for administrative purposes in these organizations was also limited. In no instance was an occasion discernible which would show that case records were used for checking and increasing the proficiency of personnel under health officer direction. Neither was there any indication that the county supervising nurse or the State nursing consultant utilized these records for conducting their conferences with staff members.

Such discrepancies between service and the recording thereof raised doubt concerning the value of elaborate record systems adopted indiscriminately by health departments, regardless of their needs. That the experience of the health units studied does not represent isolated peculiarities is indicated by the fact that both the Committee on Records and Reports to State and Territorial Health Officers and the United States Public Health Service,[8] and the Committee on Administrative Practice [9] now recognize service entries made on an index

[5] See footnote 3 (*b*).

[6] See footnote 3 (*c*).

[7] See footnote 3 (*d*).

[8] Committee on Records and Reports to State and Territorial Health Officers and the United States Public Health Service: Tabulation of Health Department Services. Pub. Health Rep., 51:1236 (September 4, 1936).

[9] Committee on Administrative Practice: Appraisal Form for Local Health Work. American Public Health Association. New York City, 1938.

card or other special form as well as those made on case records, particularly if further service is not contemplated These modifications of record keeping requirements, together with the afore-mentioned situations found in the three counties receiving special consideration, stimulated the interest of this office in the possibility of finding some device for supplying the data actually used.

Inclusion for experimental purposes of an index card (see below) proved to be a most satisfactory method of providing essential information for the three areas studied. Index cards are not new to record systems; as a matter of fact, an index is a part of most plans but the index usually serves either as a lead to the case record file,[10] or as an integrating device for the general record system.[11] Inasmuch as a high proportion of services are not described by entries on case cards, it was decided to expand the purpose of the index to identify all persons contacted, to describe briefly the service rendered, and to allocate services to specific workers. Even with this expansion, the form represents a rudimentary type of record which was designed primarily to supply the types of needed information not otherwise available because of the incompleteness of the case record file.

No ......

.... W C ...... M F ......

(Family name) (First name)

H H Head .... Dist ....

Date of birth .... Open country ....

Address .... Village ....

Date	Place	Purpose of contact	Worker

Individual index card.

In many instances the completion of periodic summary reports represents the main use made of records. For this purpose the daily reports of individual workers offer the most usable source of information. There are, however, certain analyses of health department practices which need to be made at least annually if the program is to be guided intelligently. These analyses may relate to performance of the health department staff as a whole or to service to individuals.

[10] Walker, W. F., and Randolph, Carolina R.: Recording of Local Health Work. The Commonwealth Fund, New York City, 1935.

[11] Bellows, Marjorie T., and Ramsey, Geo. H.: Integration of Health Department Records. Am. J. Pub. Health, Vol. 29, No. 26, June 1939.

Such evaluations are facilitated by the inclusion of a record form which is characterized by simplicity, yet which offers maximum possibilities for the types of analysis that are of distinct administrative value. The extent to which the index might be used in supplying information that seems most important in routine health administration was given particular attention. An index record that may be prepared from entries made by staff workers on their daily reports is well equipped to furnish the kind of source material required by most health officers for study of the activities of the department as a whole. Likewise, it would furnish such basic data as commonly appear in annual reports of local health organizations.

A brief description of the items provided for and of the method of recording such information on the index form might be given at this point. The first section of the card is devoted to descriptive and identifying data which are as essential to analysis of service as are the service entries themselves. Name of the client and of the head of the household (H. Head) should be entered in full, as should the location of his residence. For sanitation services the two latter items will serve to identify the premises. The recorded date of birth will reveal whether a client is an adult, a school child, one of preschool age, or an infant. Other information for this section of the card can be indicated by the use of a check mark in the appropriate space. Correctly placed checks will indicate whether the person served is white or colored (W C), and whether a male or female (M F). They will also designate the type of community in which his home is located (open country or village). The section of the card which constitutes a history of services is completed by making the following entries for each separate contact: Date of service, place of service (home, school, office, clinic), purpose of contact (immunization, physical examination, health supervision, sanitary survey, promotion of clinic attendance, instruction regarding control of communicable disease, arrangement for admission to sanatorium, etc.), and identification of the health department worker (health off., A. B., San. insp., C. D., nurse, E. F., etc.). Initials of the person rendering service, in addition to his title, are especially important in larger health departments where more than one worker of each professional class is employed.

The index is the only device which permits a record of total service to unduplicated individuals, for in no other system is the recipient the basis of consideration.

A client's card becomes a part of the index file with his first health department contact, and all subsequent contacts are recorded thereon. Index records may be filed alphabetically according to name of the individual served or of the household head, depending on whether the department chooses to handle its clients singly or in family groups. The alphabetic guide cards might be replaced by a phonetic system,

thus facilitating filing and location of records; such a system is especially useful where the department has a large clientele.

From an index record such as the one suggested it is possible to obtain a description of every person served by the health department. Thus the administrator may procure an actual count of infants, preschool children, school children, and adults who are reached by his organization during any chosen period of time. He can tell how many of these persons are white and how many are colored, as well as the sex of each. By comparing the count of clients in the separate categories with the total number of each in the population, a health officer can calculate the distribution of health department services. In addition, he can decide whether lack of balance exists in the selection of clients from particular sections of his jurisdiction.

The index record is a means of determining the total amount and the various types of service received by every person brought within the range of health department activity. Likewise, it is possible to identify those seen for a single purpose or for any given number of purposes and to compute the aggregate number of contacts made by the complete staff. No other record pattern permits these two types of analysis.

Not only does the index provide a history of services rendered by the entire staff, but each item of activity can be assigned to the individual worker responsible for its performance. Only the index tells a story of the related service of various workers to each client. From a record of this kind, the health officer can learn the degree to which his personnel cooperate in their handling of specific conditions, and whether the home, office, or clinic is apt to be the place of contact; he can also compare the proportion of the population served by the several staff members. Finally, the index lends itself to analysis of seasonal variation in health department activities, both from the standpoint of number of individuals served during specified periods and from the aspect of types of work emphasized at particular times. These suggested analyses are based on the types of data called for by the very simple index card described. The analysis made by Mountin and Flook[11] of the scope of personal service rendered by the health departments already referred to was based entirely upon information provided by this elementary index form. Items designed to describe in further detail either the individual or the service might readily be included, although each additional item makes record keeping more burdensome and complicates the analysis.

Limitations inherent in the index as a major element of a record system must be fully understood. Especially do these limitations apply to its use in large health departments where the roster of clients attains considerable magnitude and record files are decentralized.

[11] See footnote 3 (e)

The apparent simplicity of the sample index card, as judged by its size and the small number of items, may mislead the uninitiated into believing that the clerical problems of an office are automatically solved with its adoption. At most, an index can only simplify record keeping and facilitate the completion of uninvolved reports and analyses. The form is of limited value unless each staff worker faithfully records every service rendered to individuals and to premises. Furthermore, even the primary analyses described in this paper necessitate a large amount of sorting of cards and tabulating of data recorded thereon. The quantitative data required by administrators of small departments for completion of reports could be extracted by hand sorting with relative ease. One method of handling the card file which would partially mechanize the procedure is the use of the marginal punch system. Experience has shown, however, that this device is adaptable only to relatively small numbers of cards. Access to card punching and mechanical tabulating equipment naturally expedites the task of analysis. In the larger departments where the record system is completely mechanized, the items necessary for index purposes could be entered on the control portion of a punchcard, while the remaining columns are reserved for a description of the service. By the use of mechanical equipment it would be possible to allocate the various services to unduplicated recipients who can be described in any way that the analyst might desire.

Characteristics of the index as described in the foregoing discussion lead to the opinion that there are several noteworthy advantages to its adoption as an element in a record keeping system. The index offers a record of total service to unduplicated individuals, thereby forming a basis for computing the aggregate volume of work performed by the health department; it furnishes a description of every person with whom the organization made contact; it provides a history of the related service of various workers; and it permits consideration of seasonal variation in health department activities. It must be emphasized that the index is not recommended as a substitute for the case record in departments that are disposed to maintain and use the more elaborate system. It is conceivable, however, that under certain conditions the index may be the primary reference file.

STUDIES OF SEWAGE PURIFICATION

XI. THE REMOVAL OF GLUCOSE FROM SUBSTRATES BY ACTIVATED SLUDGE [1]

By C. C. Ruchhoft, *Principal Chemist*, J. F. Kachmar, *Junior Chemist*, and W. Allan Moore, *Junior Chemist, United States Public Health Service*

In a previous paper (*1*) of this series, the sewage organic matter adsorption, removal, and oxidation characteristics of activated sludge

[1] From the Stream Pollution Investigations Station, Cincinnati, Ohio

were studied. The very high rate of removal of the organic matter of sewage by the sludge and the portion of this removal which could be accounted for by biochemical oxidation was determined. From 2.5 to 30 percent reduction of the total carbonaceous oxygen demand (L value) of the substrate was accomplished by biochemical oxidation in the first 30 minutes of the process. The remarkable similarity between the purification accomplished by the biologically simple pure culture zoogleal sludge and the normal activated sludge was noted.

In these studies synthetic sewage containing true colloidal and soluble organic material only, and domestic sewage containing organic material in all states of dispersion were used. It has been shown that only about 6 to 10 percent of the organic material contained in domestic sewage is present in true colloidal form and that roughly 33 to 44 percent may be present in true solution (*2*, *3*, *4*).

Because of the large portion of organic material present in true solution in sewage it is pertinent to study the rates of removal of such material by activated sludge. The rates of removal of non-electrolyte solutes from substrates by the activated sludge process have not been extensively studied under controlled conditions. It was, therefore, decided to study this phenomenon and to use the simple carbohydrate glucose as a test material. Glucose was selected because of interest in it as a cause of sludge bulking, because its removal can readily be followed directly, and because of the ease with which it can be used for energy by bacteria. Kendall (*5*) states that no case has been recorded of a bacterium which can utilize any carbohydrate that will not utilize glucose also, and there are organisms which do not utilize any carbohydrate except glucose for energy requirements.

In the present study the rates of removal of glucose obtained with normal activated sludge as taken from an experimental plant and pure culture zoogleal sludge have been compared. The pure culture zoogleal sludge consists of the flocs formed by a strain of bacteria isolated from normal activated sludge. The isolation of these bacteria and the development of the pure culture sludge have been described by Butterfield (*6*). The rates of removal of glucose and sewage organic matter by activated sludges have also been compared. The influence of sludge concentration, temperature, and pH upon the glucose removal rate has been studied. The effect of other factors such as agitation without oxygen, prolonged reaeration, supplemental feeding, and chlorination of activated sludge upon the glucose removal rate has also been determined.

REVIEW OF LITERATURE

The theory of removal of dispersates of larger than colloidal size by coagulation or condensation on the surface of the sludge particles

is readily acceptable. This suggests that the mutual coagulation theory proposed by Baly (*7*) and frequently reviewed in the literature (*8*, *9*, *10*, *11*) may be necessary only to explain the removal of the rather small proportion of colloidal organic matter present in the sewage. Baly concluded that lowering the pH of the system to 6.5 to 6 should promote the efficiency of the process. Lumb (*8*) cited experiments to show the advantage of lowering the pH, but Nesmehanoff's (*12*) experiments in which the pH was lowered to slightly under 6 resulted in a decrease in the activity of the sludge, and Mohlman (*11*) states that Baly's suggestion has not been put to practical use.

In any case, the organic materials in solution which include electrolytes and nonelectrolytes are not removed from the dispersions medium by the above coagulation or electro-adsorption mechanisms. Theriault (*13*, *14*, *15*) proposed a biozeolytic theory for the removal of ions of solutes and stated that adsorption of ammonia, amino acids, lignoproteins, and related organic constituents could be explained in terms of base exchange.

Theoretically, this leaves the nonelectrolyte solutes as the only organic components of sewage, the removal of which could not be explained upon the basis of one of the several rapid physiochemical mechanisms conceivably present and active in the activated sludge process. To remove the nonelectrolytic solute it is necessary to fall back upon a biophysical-chemical mechanism such as direct cell action or, as Buswell (*16*) has termed it, bioprecipitation.

The flocs of activated sludge consisting of zoogleal bacteria described by Butterfield (*6*) and Dienert (*17*) are heterogenous systems involving enzymic colloids and solutions of cellular materials. Consequently the reactions of these systems upon substrate are also biophysical-chemical. In this case the reaction velocity would seem to be dependent upon the quantities of the biological agents present to activate the reaction. Butterfield and Wattie (*18*) have shown that the immediate rate of biochemical oxidation of a substrate is proportional to the initial bacterial population. The maximum hourly rate of oxidation for a given substrate was obtained with the maximum number of organisms (10,000,000 per ml. in their experiments) present at the start. This maximum hourly rate became lower and required a longer time to attain as the initial number of bacteria that were present to activate the reaction became smaller.

The bacterial dissimilation of glucose has been extensively studied. Thaysen and Galloway (*19*) have ably reviewed the work in this field and their views are briefly summarized here. The mechanism of glucose dissimilation is generally accepted to depend upon the activation of hydrogen atoms in the glucose molecules and their subsequent removal by hydrogen acceptors according to the theory of Wieland

(*20*). The molecule containing the activated hydrogen (glucose, in this case) is termed the hydrogen donator and the oxygen or other hydrogen absorbing molecule or molecule radical, the hydrogen acceptor. The living plasma, or enzymes produced by the plasma, act upon the molecule of glucose in the substrate in which the plasma is suspended. This makes a transfer of hydrogen possible. According to this theory the function of oxygen has been reduced to that of the hydrogen acceptor. This function it shares with numerous other substances such as methylene blue, litmus, nitrates, etc. The reaction between the hydrogen donator and the hydrogen acceptor is considered an oxidation-reduction reaction. Although the oxygen may function as a hydrogen acceptor without preliminary activation, some authorities favor the view that an activation is necessary before oxygen becomes capable of combining with activated hydrogen.

Glucose is first esterified into monophosphoric esters, after which it is decomposed by the living cell, according to the mechanism described, into compounds containing less than six carbon atoms. The course of the decomposition and the final products formed depend upon the hydrogen activating properties of the organisms involved in the system. Kluyver and Donker (*21*) have reduced the fermentation activities of micro-organisms to eight types.

The type of glucose fermentation or dissimilation that takes place in activated sludge has not been adequately studied. Butterfield (*6*) reported that the zoogleal bacterium isolated from activated sludge grew well in the presence of glucose in nutrient broth but that no gas was formed and, as evidenced by changes in pH, no acid was produced. Heukelekian (*22*) added 1,000 p. p. m. of glucose to activated sludge suspensions under mechanical agitation and found that less than 10 percent of the glucose was removed in an hour. He concluded that, as biological action could not be precluded, this removal could not be ascribed to adsorption. Seiser (*23*) experimented with glucose as a nutrient for activated sludge and concluded that, when glucose was fed with asparagin, twice as much glucose was removed by adsorption as was removed by biological decomposition.

A very serious case of sludge bulking occurred at the Des Plaines River activated sludge plant in 1927, and Morgan and Beck (*24*) found a large quantity of glucose (10,400 p. p. m.) in a portion of the sewage. The glucose tripled the B. O. D. load upon the plant and resulted in a breakdown in plant operation. Ruchhoft and Watkins (*25*) tentatively identified the predominant infesting organism in the diseased activated sludge at this plant as the filamentous organism *Sphaerotilus natans* and showed that the organism could be cultured upon a dextrose peptone phosphate agar. Pearse (*26*) reviewed the literature upon excessive carbohydrates in relation to sludge bulking. Agersborg and Hatfield (*27*) found a rather poor activated sludge at

Decatur and stated that the presence of 8 p. p. m. of dextrose probably encouraged the abundant growth of *Sphaerotilus natans* in the aeration tanks. Scott (*28*) observed great increases in the volume of activated sludge to which dextrose had been added. He showed that once the quantity of sludge had been increased, long periods of aeration decreased the volume very little. Eldridge and Robinson (*29*) and Eldridge, Mallman, and Robinson (*30*) reported that up to 400 p. p. m. of lactose were removed from solution by aeration with activated sludge in 6 to 8 hours. They noted an increase in pH of from 7.2 to 8.1 after carbohydrate feeding and suggested that the carbohydrate was completely oxidized in the above period. They obtained decreases in the quantities of suspended solids in their aeration tanks following lactose feeding and did not obtain any appreciable bulking until the sludge had been aerated 3 days without being fed. Infection of the sludge by *Sphaerotilus* was not mentioned by these observers.

Smit (*31*, *32*) found that carbohydrates such as glucose, sucrose, lactose, and starch in quantities up to 1,000 p. p. m. were all rapidly removed from sewage and that the prolonged addition to activated sludge of sewage containing carbohydrates in such quantities in time produced poor sludge infested with the filamentous organism *Sphaerotilus natans*. He concluded that the average sugar content of about 25 p. p. m. found in the strong Amsterdam sewage (8 to 18 gallons per capita) was far below the limit of harmfulness to activated sludge. Smit also stated that the products of glucose metabolism were not found, that, contrary to his expectations, acids could not be traced, that the pH changed very little and further experiments were needed to decide whether all of the sugar had been oxidized to carbon dioxide or whether other products had been formed. Schmiedt (*33*, *34*) has denied the deleterious effect of carbohydrate on activated sludge and has reverted to the Willstätter theory of ferments adhering to the colloids to explain the oxidation phenomenon in activated sludge. He agrees, however, that wastes consisting mainly of carbohydrates are more difficult to treat than sewage containing colloidal albuminoid material.

From the above brief review it may be surmised that our knowledge regarding the removal of glucose from solution by activated sludge, the nature and relative quantities of dissimilation products formed from glucose by the reaction with activated sludge, and the effect of this reaction upon the sludge is fragmentary.

GENERAL EXPERIMENTAL PROCEDURE

In these experiments 3 liters of the activated sludge mixed liquor chosen for study were transferred to a 4-liter pyrex serum bottle and the suspended sludge solids were allowed to settle for about 30 minutes. After settling, most of the supernatant liquor was

siphoned off, a volume of solution containing from 2 to 3 grams of glucose was added, and the volume was made up to 3 liters with distilled water. A small portion, about 50 to 60 ml. of the initial activated sludge glucose mixture, was immediately removed from the aeration bottle for determination of the suspended solids, ash, pH, and glucose content. The mixture was aerated continuously for definite periods, after which samples were withdrawn for analysis.

ANALYTICAL METHODS

The suspended solids and ash were determined according to Standard Methods (*35*). The pH determinations in all experiments were made electrometrically employing a glass electrode.

An adaption of the method recommended by Hassid (*36, 37*) for the determination of glucose in plant saps was used for the glucose determination. This method involves the reduction of potassium ferricyanide to ferrocyanide by the glucose in slightly alkaline media and the subsequent volumetric estimation of the ferrocyanide by oxidation with dilute standard ceric sulfate solution using Setopaline C as an internal indicator. The method is very simple and it is possible to make 90 to 100 glucose determinations in 5 hours with it.[2] Hassid states that the method has an accuracy compared with the Munson-Walker method of within 2 to 3 percent. Our results with it indicate reproducibility within 3 percent.

Preliminary tests indicated that our Cincinnati sewage and the supernatant liquor from the experimental activated sludge plant at the station contained only negligible quantities of materials capable of reducing ferricyanide (equivalent to 6 p. p. m. of glucose or less). Consequently, it was unnecessary to make blank glucose determinations upon sludge liquor or sewage to which glucose was to be added or to use and analyze an unfed sludge control.

EXPERIMENTAL RESULTS

Typical results obtained in four experiments on glucose removal by activated sludge are tabulated in table 1 and plotted in figure 1. These data confirm Smit's (*31*) results indicating that normal activated sludge sometimes removes glucose from solution very rapidly. In these experiments about 25 percent of the glucose was removed in

[2] For this determination the sample of activated sludge liquor is withdrawn from the aeration bottle, filtered through No. 1 Whatman paper (further clarification is unnecessary) and a volume of filtered solution containing approximately 1 mg. of glucose is pipetted from a 2-ml. pipette (graduated in 0.1 ml.) into a 28×145 mm. test tube. Five ml. of alkaline ferricyanide are added and the tube is put into a wire basket which is placed in a 2-liter container of boiling water and heated for 15 to 17 minutes. Generally 8 to 18 tubes are heated at one time. Immediately following the heating period the tubes are cooled for 3 to 5 minutes in running water, acidified with 5 ml. of 5 N. H_2SO_4 and 7 drops of the 0.1 percent aqueous Setopaline C indicator solution are added. The sample solutions are then rinsed from the tubes into 125 ml. Erlenmeyer flasks and titrated with approximately 0.01 N. standard ceric sulfate from a 5-ml. microburette. The ceric sulfate is standardized against a carefully prepared 1,000 p. p. m. solution of glucose in distilled water.

30 minutes, after which the percentage removal increased rapidly until glucose was depleted in 5 to 10 hours.

TABLE 1.—*Typical glucose removal results obtained with activated sludges, at room temperature*

	Normal activated sludge				Pure culture zoogleal sludge No. 83			
Experiment number	G 7		G 8		G 26		G 42	
Sludge solids, p. p. m.	2,011		1,884		526		2,261	
Volatile solids, p. p. m.	1,432		1,328		518		2,124	
Glucose feed, p. p. m.	699		979		965		716	
Time	Glucose removed p. p. m.	Percentage removed	Glucose removed p. p. m.	Percentage removed	Glucose removed p. p. m.	Percentage removed	Glucose removed p. p. m.	Percentage removed
Initial after mixing	33	4.72	59	6 03		0	0	0
10 minutes	101	14.4	150	15.3				
15 minutes					20	2.07	16.0	2.23
20 minutes	155	22.2	199	20.3			42.0	5.87
30 minutes	205	29.3	212	24.7	0	0	61.0	8.52
45 minutes	255	36.5	[1] 297	30.3	27	2.80	113.0	15.8
60 minutes	275	39.3	344	35.1	45	4.66	157.0	21.9
75 minutes			392	40.0	38	3.94		
90 minutes	355	50.8	370	37.8	11	1.14	163.0	22.7
2 hours	446	63.8	474	48 4	86	8.91	210.0	29.3
3 hours	556	79.5	664	67.4	51	5.28	[2] 260.0	36.3
3½ hours							304.0	42.5
4 hours					118	12.2		
4½ hours							423.0	59.1
5 hours	690	98.7	894	91.3				
23 hours	695	99.4	977	99.8	822	85.2	687.0	95.9

[1] 40 minutes. [2] 2¾ hours.

Pure culture zoogleal sludge removed glucose at a considerably lower rate than did normal activated sludge. The quantity of bacteria present very decidedly influenced the rate of glucose removal. With 526 p. p. m. of zoogleal bacteria (Exp. G 26) only 12.2 percent of glucose was removed in 4 hours, while with 2,264 p. p. m. of bacteria (Exp. G 42) 21.9 percent was removed in 1 hour and 59.1 percent in 4½ hours. On the basis of these removal performances it may be assumed that activated sludge contains organisms and enzymes more efficient in their glucose removal powers than these pure zoogleal cultures.

A comparison was made of the glucose removal rate obtained with activated sludge, with sewage, and with several of the biological agents common to sewage. These data are given in table 2 and indicate that about 2,000 p. p. m. of good activated sludge removes glucose at a much higher rate during the first 3-hour aeration period than any of the other agents tried. There is a lag of 5 hours before appreciable quantities of glucose are removed by Cincinnati domestic sewage. With cultures of *Bacterium aerogenes* and *Bacterium coli* containing about 21.6 and 32.6 million viable cells per ml., respectively, a lag of 3 hours was observed before appreciable quantities of glucose were removed. The much greater and earlier rate of glucose removal

obtained with activated sludge gives evidence of the tremendous bacterial populations present in this sludge. It has been estimated (*18*) that activated sludge contains about 10,000 million bacteria per ml.

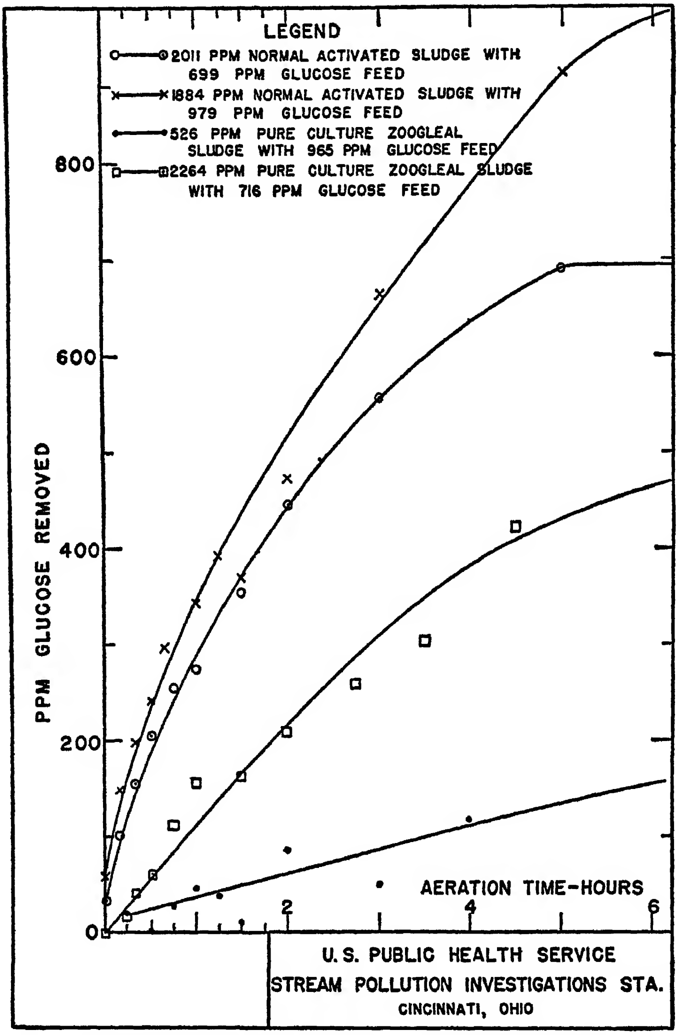

FIGURE 1.—Typical glucose removal curves for activated sludges.

The *Sphaerotilus natans* culture containing 422 p. p. m. of these organisms removed glucose at a considerably lower rate than the activated sludge.[3]

[3] When *Sphaerotilus natans* cultures are tested for glucose removal, the substrate must be properly balanced with nitrogenous and mineral constituents or glucose is removed very slowly. In this experiment glucose was fed with synthetic sewage under conditions in which maximum rates of removal are obtained.

TABLE 2.—*Comparison of various biological agents in removing glucose from solution under aeration, at room temperature*

Aeration time, hours	Glucose removed, p. p. m.					Percentage of glucose removed				
	Activated sludge [1]	*Bact. aerogenes* culture [2]	*Bact. coli* culture [3]	Domestic sewage	*Sphaerotilus natans* culture [4]	Activated sludge	*Bact. aerogenes* culture	*Bact. coli* culture	Domestic sewage	*Sphaerotilus natans* culture
½	172			0		17.2				
1	306	27	0	0		30.6	2.7	0		
3	660	46	13	0		66.0	4.6	1.3		
5	895	577	195	7	181	89.5	57.7	19.5	0.7	36.2
6½				350					35.0	
10½	[5]	660	424			100	66.0	42.4		
13				920					92.0	
24		704	771	[5]	480		70.4	77.1	100	96.0

[1] Activated sludge of 1,940 p. p. m. suspended solids dosed with 1,000 p. p. m. of glucose.
[2] A 48-hour 20° C. culture in standard nutrient broth was dosed with 1,000 p. p. m. of glucose. Initial count in mixture was 21.6 million per ml.
[3] A 48-hour 20° C. culture in standard nutrient broth was dosed with 1,000 p. p. m. of glucose. Initial count in mixture was 32.6 million per ml.
[4] A 24-hour culture in synthetic sewage containing 422 p. p. m. of organisms was dosed with synthetic sewage containing 500 p. p. m. of glucose.
[5] Complete.

It is interesting to compare the rate of glucose removal of these sludges and the removal of B. O. D. of sewages reported previously (*1*). It may be assumed, for the purpose of this comparison, that the B. O. D. of glucose is removed at the same rate as its disappearance from solution. Using typical experiments, this comparison for normal activated sludge is as follows:

Experiment number	Quantity of sludge, p. p. m.	Feed	L value [1]	Percentage reduction of L value after indicated time in hours				
				½	1½	3	5	10
7	2268	Settled sewage	334	55.1	74.6	81.7	88.5	92.8
G 7	2011	Glucose	745	29.2	50.9	79.5	98.7	99+
5	2812	Synthetic sewage	385	29.1	35.8	44.2	52.2	76.4

[1] Total carbonaceous B. O. D.

This suggests that for the first 2 hours the rate of glucose removal by normal activated sludge is lower than the rate of removal of sewage organic matter which is largely suspended and colloidal material. Glucose, however, seems to be removed more completely in a shorter time than the nitrogenous organic matter (peptone and meat extract) in synthetic sewage.

A similar comparison of the B. O. D. removal obtained by pure culture zoogleal sludge follows:

Experiment number	Quantity of sludge, p. p. m.	Feed	L value [1]	Percentage reduction of L value after indicated time in hours			
				½	1½	3	5
9	2,112	Settled sewage	414	68.4	81.3	89.3	91.7
G 42	2,268	Glucose	764	8.52	22.9	39.8	63.8
2	1,632	Synthetic sewage	384	39.8	55.7	81.5	86.8

[1] Total carbonaceous B. O. D.

This comparison indicates that the ability of the zoogleal culture to remove B. O. D. of sterile or synthetic sewage is much superior to its ability to remove glucose from solution.

Several experiments to determine the rate of glucose removal with increasing quantities of sludge have been completed. All of these have indicated that the rate of removal is directly related to the quantity of sludge under aeration. The data of a typical experiment are given in table 3 and the results for glucose removal are plotted in figure 2. The glucose removal results with the three lower sludge concentrations, A, B, and C, show irregularities during the first hour. Thereafter, however, the glucose removal is quite regular with all concentrations of sludge. As table 3 shows, the quantities of sludge solids present after 3 and 5 hours of aeration were definitely increased with the removal of glucose. The volatile matter content of these sludges also increased during the 5-hour aeration period. The mean volatile matter content of the sludges in this experiment was 50.95 percent at the start, increasing to 54.84 percent after 3 hours and to 56.44 percent after 5 hours.

TABLE 3.—*Glucose removal with increasing quantities of activated sludge, at room temperature*

Experiment G 17	A	B	C	D	E	F
Initial pH	7.2	7.2	7.2	7.2	7.2	7.2
Sludge solids p. p. m.:						
Initial	831	653	1,253	1,973	2,621	3,136
After 3 hours	803	716	1,336	2,052	2,632	3,188
After 5 hours	868	752	1,384	2,100	3,008	3,552
Glucose feed p. p. m	515	515	515	515	515	515
Time	Glucose removed, p. p. m.					
Immediately after mixing	1.8	−6	−8	−5	25	48
15 minutes	3.2	15	42	27	54	64
30 minutes	46	43	29	51	80	82
60 minutes	23	21	60	75	103	142
2 hours	47	60	105	157	201	236
3 hours	52	78	141	216	284	356
5 hours	67	117	223	306	415	485
24 hours	199	365	[1]	[1]	[1]	[1]

[1] Complete.

The increasing rates of glucose removal for increasing quantities of sludge, after the first hour, suggest that the Freundlich adsorption law may apply. If this is true the removal data obtained after any time for all sludge concentrations should satisfy the expression:

$$\frac{X}{M}=a\ C^b$$

or

$$\log\frac{X}{M}=b\log C+\log a$$

where

X=quantity of glucose removed
M=quantity of sludge used
C=concentration of glucose remaining in solution
a and b are constants.

The data obtained in the above experiment from the first to the fifth hour, inclusive, have been arranged in table 4 for plotting. In this computation the sludge solids results have been adjusted so that each higher concentration is an exact multiple of the lowest concentration.

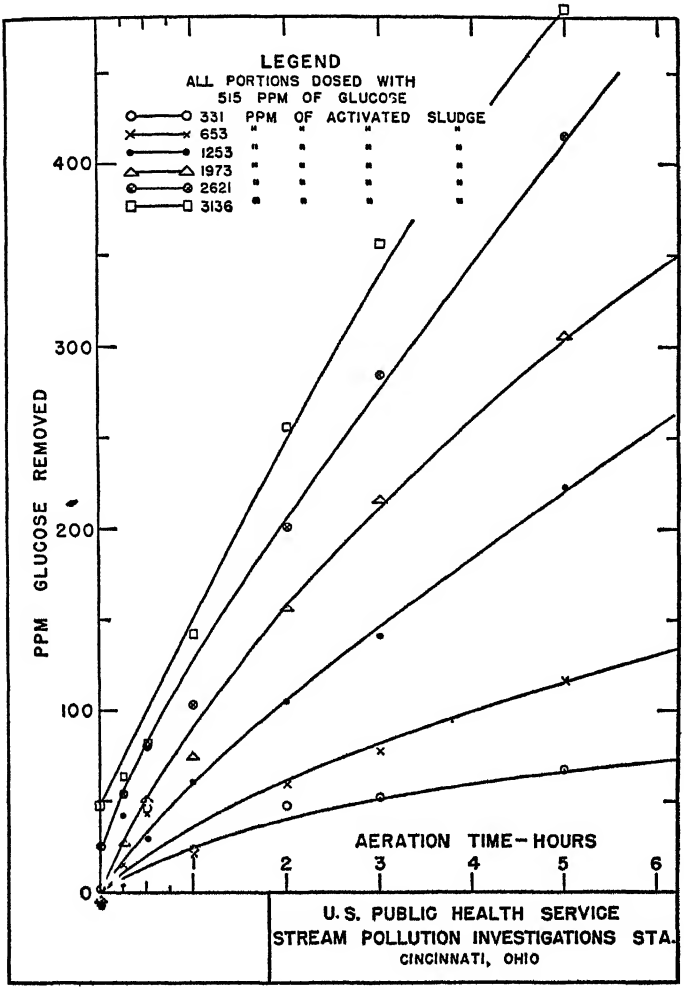

FIGURE 2.—Glucose removal with increasing quantities of activated sludge.

The initial suspended solids results were used with 1- and 2-hour glucose removal observations and the 3- and 5-hour suspended solids results were used with the removal observations at the corresponding times. These data have been plotted on a log-log scale, as shown in figure 3, with interesting results.

TABLE 4.—*Data of experiment G 17 arranged for plotting to determine the application of the Freundlich adsorption expression*

Sludge mixture	Initial sludge solids (M) p. p. m.	Aeration time—hour at which observations were made							
		1		2		3		5	
		$\frac{X}{M}$	C	$\frac{X}{M}$	C	$\frac{X}{M}$	C	$\frac{X}{M}$	C
A	325	0.071	492	0.145	468	0.157	463	0.191	448
B	650	.032	494	.092	455	.117	437	.167	398
C	1,300	.046	455	.081	410	.106	374	.159	292
D	1,950	.038	440	.081	358	.108	299	.146	209
E	2,600	.040	412	.077	314	.107	231	148	100
F	3,250	.044	372	.079	258	.107	159	.138	83

$\frac{X}{M}=\frac{\text{p. p. m. of glucose removed}}{\text{p. p. m. of sludge solids}}$
C=p. p. m. of glucose remaining in solution.

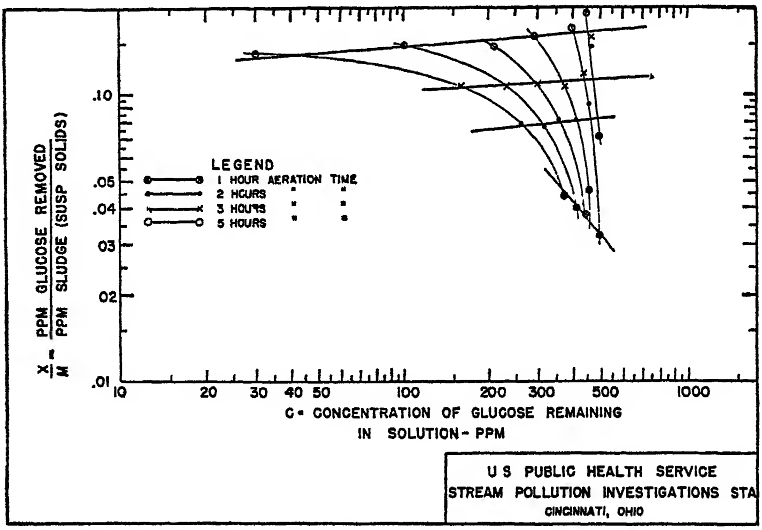

FIGURE 3.—Relation between the ratio of glucose removed to the sludge solids and the concentration of glucose remaining in solution.

This figure shows that all points except those representing the lowest concentration of sludge fall within a reasonable distance of a straight line for the 2-, 3-, and 5-hour observations. A straight line may also be drawn through 4 of the 5 points for the 1-hour observation, neglecting the point for the lowest sludge concentration. Considering the relatively small quantities of glucose removed in 1 hour and the possibility of error in the glucose determinations, it is not surprising to find one of these observations with the lower sludge concentrations in disagreement. The observation points for each sludge concentration from the first to the fifth hour have been connected with a light curved line simply for convenience in following the movement of the

point for a given sludge concentration with increasing aeration time. The straight line obtained at each observation time indicates that this reaction follows the expression $\log \frac{X}{M} = b \log C + \log a$. Consequently, it may be concluded that with normal activated sludge concentrations of 650 to 3,250 p. p. m. and a glucose concentration of about 500 p. p. m. the Freundlich expression applies between the first and fifth hour. Agreement with this expression was not obtained when sludge concentrations below 650 p. p. m. were used.

The results of one experiment, in which 478, 906, and 1,088 p. p. m. of pure culture zoogleal sludge were tested for glucose removal ability, were similar to the above results with normal activated sludge. These results are given in table 5. The removal obtained with all zoogleal sludge concentrations were irregular during the first hour. Thereafter the removal results were fairly regular. Additional work with a larger number of concentrations of sludge is necessary to determine whether glucose removal by pure culture sludge also follows the Freundlich expression.

TABLE 5.—*Glucose removal with increasing quantities of pure culture zoogleal sludge*

Experiment G 16	D	E	F
Sludge solids, p. p. m.	478	906	1,088
Glucose feed	631	631	631
Time	**Glucose removed, p. p. m.**		
Initial after mixing	0	0	17
15 minutes	22	51	84
30 minutes	41	76	123
45 minutes	24	63	109
60 minutes	35	70	105
90 minutes	9	55	91
2 hours	16	76	101
3 hours	21	120	115
5 hours	71	[illegible]	239
23½ hours	365	603	608

OTHER FACTORS AFFECTING GLUCOSE REMOVAL BY ACTIVATED SLUDGE

Temperature is one of the most important factors affecting glucose removal by activated sludge. In one experiment, to determine the effect of heat on the general removal mechanism, three portions of normal activated sludge were heated to 35°, 45°, and 55° C., respectively, for 10 minutes and cooled to room temperature. Then 1,000 p. p. m. of glucose were added to these three portions and to an untreated portion and all four portions were aerated at room temperature. The glucose removal results obtained are given in table 6 and plotted in figure 4. This experiment showed that warming to 35° C. had no measurable effect upon the rate of glucose removal by activated sludge. Warming for 10 minutes at 45° C., however, had

a very definite retarding effect upon the glucose removal rate, and for 10 minutes at 55° C. practically destroyed the ability of activated sludge to remove glucose during the first 4-hour aeration period. The glucose removal ability of this sludge was recovered, however, within the first 24-hour aeration period. This experiment suggests that the glucose removal rate by activated sludge depends upon an enzymic bacterial reaction which is very sensitive to temperatures over about 45° C. for even a short time.

TABLE 6.—*Effect of warming normal activated sludge to various temperatures for 10 minutes upon its glucose removal ability*

[Sludge solids 3,200, volatile sludge solids 1,955; pH=7.3, glucose feed 1,000 p. p. m.]

Sludge portion treatment	A Untreated	B 10 min. at 35° C.	C 10 min. at 45° C.	D 10 min. at 55° C.
Aeration time	Glucose removed, p. p. m.			
Initial after mixing	67	53	22	34
15 minutes	179	180	73	19
30 minutes	247	225	149	71
45 minutes	282	297	197	10
60 minutes	367	338	216	−2
75 minutes	446	414	282	56
90 minutes	474	471	306	50
2 hours	552	510	354	58
3 hours	758	767	527	50
4 hours	928	907	638	82

In two experiments the effect of aeration temperature upon glucose removal by normal activated sludge was studied. In the first test, aeration temperatures of from 2° to 28° C. were used, and in the second trial, temperatures from 18° to 44° C. were maintained. In these experiments, portions of activated sludge which had been aerated at room temperature were heated or cooled to the desired temperatures. Each portion was dosed with 1,000 p. p. m. of glucose solution at the temperature at which the sludge was to be aerated and aeration was started. The results obtained are given in tables 7 and 8 and are plotted in figures 5 and 6. These figures show that the rate of glucose removal increased very decidedly as the aeration temperature was increased from 2° to 33°–35.2° C. At the lower temperature only about 289 p. p. m. of glucose had been removed in 5½ hours, while at the higher temperature the entire 1,000 p. p. m. had been removed in 2 hours. At the highest aeration temperatures of these experiments, 41° to 44.3° C., the initial removal obtained immediately after mixing was greater than that obtained at any of the lower temperatures. The rate of removal through the first hour after the initial mixing was lower, however, than for the sludge portions aerated at about 30° and 35° C. After the first hour the removal rate fell considerably. Between the third and twenty-third hour (not

tabulated) only 222 p. p. m. of glucose were removed. This indicates that an aeration temperature of 41° to 44.3° C. is detrimental to the glucose removal mechanism of the sludge. In another experiment, activated sludge was conditioned by sewage feeding and aeration at

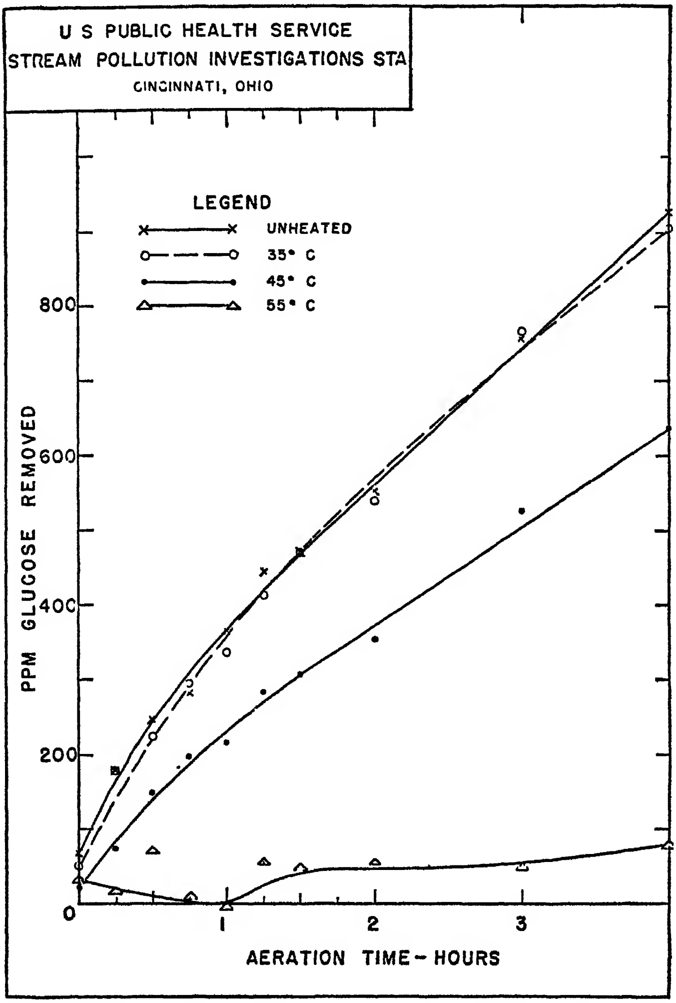

FIGURE 4.—Effect of warming activated sludge for 10 minutes to various temperatures upon its glucose removal ability.

42.6° to 43° C. for 44 hours before the glucose removal test was made. The conditioning at this temperature proved ineffective, as the glucose removal capacity was completely destroyed, thus indicating that this temperature is inimical to the enzymic glucose removal mechanism of the sludge.

TABLE 7.—*Effect of aeration temperatures upon rate of glucose removal by activated sludge, temperatures 2.0° to 28.0° C.*

[Sludge solids 2,672 p. p. m., volatile sludge solids 1,924 p. p. m., glucose feed 1,000 p. p. m.]

Sludge portion / Aeration temperature range °C	A 2.0 to 8.2	B 10.0 to 13.0	C 19.3 to 19.6	D 27.0 to 28.0
Aeration time	Glucose removed, p. p. m.			
Initial after mixing	39	43	62	44
15 minutes	71	58	126	154
30 minutes	76	118	177	255
45 minutes	103	168	250	344
60 minutes	107	221	330	415
80 minutes	135	255	370	482
100 minutes	149	268	416	584
2 hours	173	313	480	663
3 hours	213	403	636	904
4 hours	228	499	783	(1)
5½ hours	289	591	988	----------

[1] Completely removed.

TABLE 8.—*Effect of aeration temperatures upon rate of glucose removal by activated sludge, temperatures 18.8 to 44.1° C.*

[Sludge solids 2,824 p. p. m., glucose feed 1,000 p. p. m.]

Sludge portion / Aeration temperature range °C	A 18.8 to 20.0	B 24.1	C 29.8 to 31.0	D 33.2 to 35.2	E 41.0 to 44.1
Aeration time	Glucose removed, p. p. m.				
Initial after mixing	66	61	118	157	199
15 minutes	148	168	213	415	295
30 minutes	204	257	448	505	356
45 minutes	265	355	518	636	455
60 minutes	360	454	604	741	509
80 minutes	418	540	690	771	500
100 minutes	500	647	812	835	506
2 hours	559	747	971	(1)	620
3 hours	697	(1)	(1)	----------	606
4 hours	856	----------	----------	----------	674
5½ hours	(1)	----------	----------	----------	743

[1] Complete removal.

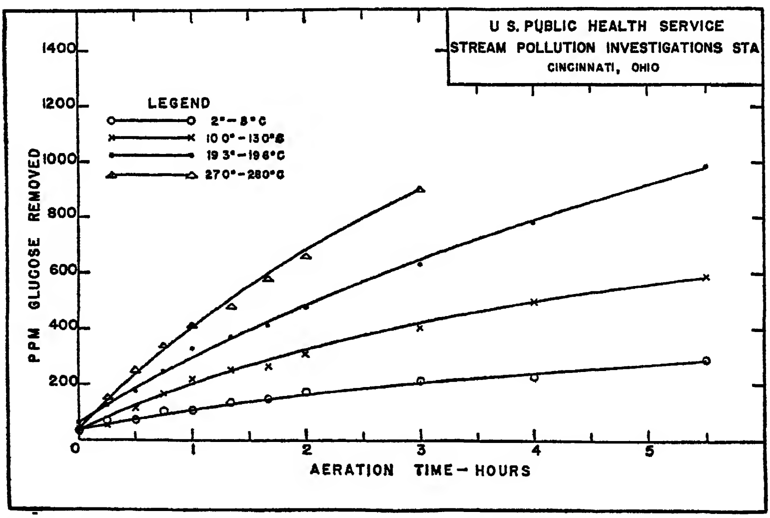

FIGURE 5.—Effect of aeration temperatures upon the rate of glucose removal by activated sludge.

In another experiment, simultaneous tests were made upon a normal laboratory sludge of good quality developed at about 25° C. and a sludge from the station experimental plant that had been operated at aeration temperatures of from about 1° to 10° C.[4] In this experi-

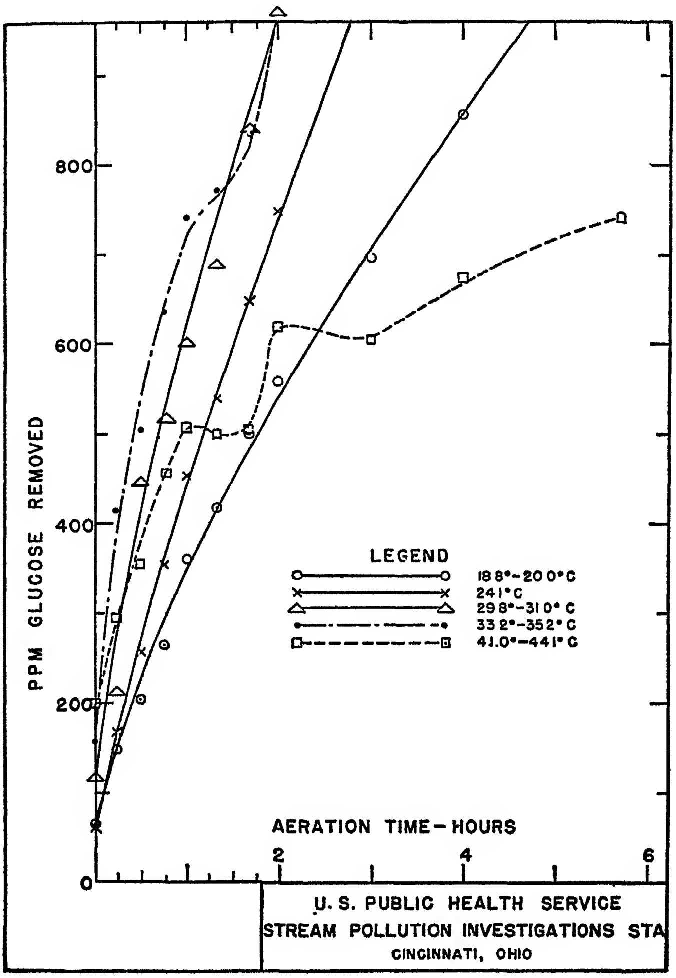

FIGURE 6.—Effect of aeration temperatures upon the rate of glucose removal by activated sludge.

ment samples of both sludges were divided into two portions, one portion of each sludge was brought to 27° C., dosed with a glucose solution at this temperature and aerated at the same temperature, while the second portion of each was brought to 1° C., dosed with

[4] This temperature range is rather broad because this small plant is located in an unheated, glass-covered building, without temperature control, subjected to winter temperatures. Consequently, the lower temperatures were obtained during the night and early morning and the maximum temperatures were reached during sunshine in the afternoon.

glucose adjusted to this temperature and aerated at the same temperature. The results of glucose removal obtained in this experiment, as given in table 9, are instructive. This experiment shows that the glucose removal depends not only upon the aeration temperature during the period of glucose removal but also upon the previous history of the sludge. The laboratory-developed sludge removed glucose at the customary rate for 27° C. when aerated at 27° C. When this sludge was cooled and aerated at 1° C. its glucose removal rate fell, but this rate was considerably higher for the first 90-minute aeration period than the removal rate for the winter temperature plant sludge aerated at 1° C. The plant sludge aerated at 1° C. removed glucose at a very low rate. At 27° C., however, this sludge did not reach the removal rate of the laboratory sludge aerated at 1° C. during the first 90-minute aeration period. This experiment suggests, therefore, that any preliminary treatment of a sludge which may affect its "quality" also affects the glucose removal rate that may be expected at any temperature.

TABLE 9.—*Comparison of glucose removal ability of activated sludge developed at winter and summer temperatures*

	Laboratory sludge, temperature 27° C. Solids=2,170 p. p. m.		Experimental plant sludge, winter temperature 1°–10° C. Solids=3,935 p. p. m.	
Aeration temperature	27.4° C.	1.0° C.	27.4° C.	1.0° C.
Aeration time	Glucose removed, p. p. m.			
Initial after mixing	115	55	13	0
15 minutes	203	128	11	5
30 minutes	309	193	25	19
45 minutes	341	200	72	25
60 minutes	384	218	75	52
75 minutes	434	243	119	36
90 minutes	478	256	149	28
2 hours	414	200	108	0
3 hours	544	216	189	35
4 hours	689	226	260	40
5 hours	832	263	349	39
6 hours	936	270	404	70

A final experiment upon the temperature factor in glucose removal was carried out with samples of the same laboratory and plant sludge used previously, but after preliminary conditioning. The laboratory sludge was dosed regularly with sewage (twice a day) and aerated at winter temperatures, 1° to 10° C., for 5 days. The plant sludge was conditioned by similar dosing and aeration at 25° to 28° C. for 3 days. Each sludge was then divided into two portions and the previous experiment was repeated. The results obtained are given in table 10. The 5-day period of cold temperature conditioning had a remarkable effect upon the glucose removal rates obtained from the laboratory sludge. This effect can be illustrated by comparing the rates of

glucose removal in milligrams per gram of sludge per liter for the first hour as follows:

Aeration temperature, °C.	*Before conditioning*	*After conditioning at 1° to 10° C. for 5 days*
25° to 27° C.	177	57
1° to 4° C.	100	43

With winter plant activated sludge the following rates expressed similarly were obtained in these experiments:

Aeration temperature	*Before conditioning*	*After conditioning for 3 days at 27° C.*
25° to 27° C.	29	123
1° to 4° C.	20	55

TABLE 10.—*Comparison of glucose removal ability of laboratory sludge conditioned at winter temperature and winter (plant) sludge conditioned at summer temperatures*

	Laboratory sludge conditioned at 1.0 to 10° C. Solids=3,010 p. p. m.		Experimental plant sludge conditioned at about 27° C. Solids=5,170 p. p. m.	
Aeration temperature	25° C.	4.0° C.	25° C.	4.0° C.[1]
Aeration time	Glucose removed, p. p. m.			
Initial after mixing	0	33	182	100
15 minutes	72	75	272	176
30 minutes	113	111	404	224
45 minutes	143	129	580	274
60 minutes	171	148	638	286
75 minutes	187	159	688	256
90 minutes	189	131	721	265
2 hours	194	139	790	323
3 hours	323	127	837	359
4 hours	515	183	894	450
5½ hours	654	288	(2)	458

[1] The aeration temperature in this portion slowly increased and reached 10° C. at the end of the 5½-hour period.
[2] Complete.

The above comparison shows that the first hour glucose removal rates for laboratory sludge were reduced almost to the rate for winter plant sludge after 5 days of winter temperature conditioning. The winter plant sludge, on the other hand, had its first hour glucose removal rate raised from 20 percent to 55 percent of the laboratory sludge rates at the low temperature and from 17 to 70 percent at 27° C. after 3 days' conditioning at laboratory temperatures. These experiments indicate the great influence of aeration temperature as a factor on the biological enzymic activity of the sludge.

EFFECT OF pH

The effect of pH upon glucose removal rates was determined by subjecting the activated sludge to the desired pH for a short time and then readjusting the sludge to about 7.2, adding 1,000 p. p. m. of glucose and completing the removal test as before. In one experiment four portions of sludge were taken, three of which were adjusted

to pH 6, 5.1, and 2.8±0.2, respectively, with N/10 phosphoric acid and allowed to stand for 20 minutes. Then all portions were readjusted to the neutral point with N/10 sodium hydroxide, the glucose was added, and the test was run. The results are given in table 11. Lowering of the pH of the sludge to 5.1 for 20 minutes had practically no effect upon its glucose removal rate, while exposure to a pH of 2.8 for 20 minutes had a most destructive effect upon the glucose removal mechanism for the first 90 minutes. Thereafter this latter sludge began to recover. In 4 hours it had not removed as much glucose as the other sludges had in 30 minutes. After 23 hours, however, this sludge had apparently recovered for the glucose removal was complete.

TABLE 11.—*Effect of lowering the pH for 20 minutes upon glucose removal by activated sludge, at room temperature*

Sludge portion	A	B	C	D
pH to which sludge was subjected for 20 minutes	7.2	6.0	5.2	2.8
pH at start	7.2	7.2	7.2	7.0
Aeration time	**Glucose removed, p. p. m.**			
Initial after mixing	65	60	58	0
15 minutes	123	151	139	2
30 minutes	205	219	295	44
45 minutes	275	263	265	23
60 minutes	329	357	363	63
75 minutes	380	366	393	39
90 minutes	423	410	374	51
2 hours	510	480	471	95
3 hours	694	683	601	136
4 hours	836	817	796	183
23 hours	(1)	(1)	(1)	(1)

[1] Complete.

The effect of pH above the neutral point was determined in a similar experiment, the results of which are given in table 12. In this experiment N/10 sodium hydroxide was used to make the desired pH adjustment and after 30 minutes the pH of each sludge was readjusted to 7.1 with phosphoric acid. The results indicate that holding the sludge at a pH of 8.1 to 9.2 for 30 minutes stimulated rather than hindered glucose removal by the sludge. When the sludge was subjected to a pH of 11 for this period, however, the glucose removal rate was reduced.

In two additional experiments the pH of a number of portions of two activated sludges was adjusted to desired points, glucose was added, and the effect of aeration at various hydrogen ion concentrations upon glucose removal was determined. The results for points below neutral are given in table 13 and for points above neutral in table 14. The data indicated very little difference in glucose removal rates for the first 3 hours in the pH range from 5.8 to 7.2. After the first 3-hour period the sludge at a pH of 6.6 maintained the maximum

removal rate, with the neutral sludge portion second and the sludge at pH 5.8 next. There was not much difference, however, in the rate obtained at any of the above pH values even after 3 hours. Portion D was aerated at pH 5.6 for 1½ hours and then readjusted to pH 5 and the aeration was continued. The data indicated that there was a decided reduction in glucose removal rates as the pH is decreased from 5.8 to 5 or lower. While 63 percent of the glucose had been removed in 9 hours at pH 5.8, only about 17 percent was removed at pH 5 during this time. At a pH of 3.9 there was apparently some glucose removal (about 126 p. p. m.) during the first 2 hours, but thereafter the glucose was apparently returned to solution. After 9 hours of aeration more than 97 percent of the glucose remained in solution and after 22½ hours about 80 percent still remained in solution. It must be concluded that at a pH of 5 the glucose removal mechanism of activated sludge is greatly impaired and at 3.9 it is practically destroyed.

TABLE 12.—*Effect of raising the pH for 30 minutes upon glucose removal by activated sludge, at room temperature*

Sludge portion	A	B	C	D
pH to which sludge was subjected for 30 minutes	7.2	8.1	9.2	11.0
pH at start	7.2	7.1	7.1	7.1
Aeration time	**Glucose removed, p. p. m.**			
Initial after mixing				
15 minutes	51	79	73	18
30 minutes	134	152	149	79
45 minutes	181	163	212	127
60 minutes	237	221	252	200
75 minutes	214	232	309	196
90 minutes	251	270	308	233
2 hours	323	331	372	275
3 hours	434	463	474	306
4 hours	507	514	541	423
21½ hours	995	987	991	991

TABLE 13.—*The effect of aeration of activated sludge at pH values below neutral upon glucose removal, at room temperature*

[Sludge solids 1,810 p. p. m.]

Sludge portion	A	B	C	D	E
pH at which sludge was aerated	7.2	6.6	5.8	5.0 [1]	3.9
Aeration time	**Glucose removed, p. p. m.**				
30 minutes	106	92	111	74	77
60 minutes	120	140	154	122	65
90 minutes	118	155	177	105	48
2 hours	246	231	226	173	126
3¼ hours	308	340	208	192	98
4 hours	369	404	328	116	45
5 hours	405	441	382	116	0
9 hours	733	806	626	167	28
22½ hours	(2)	(2)	(2)	412	200

[1] pH 5.6 for first 90 minutes.
[2] Complete.

TABLE 14.—*The effect of aeration of activated sludge at pH values above neutral upon glucose removal, at room temperature*

[Sludge solids 2,320 p. p. m.]

Sludge portion	A	B	C	D
pH at which sludge was aerated	7.0	8.1	9.6	11.5+
Aeration time	**Glucose removed, p. p. m.**			
30 minutes	3	31	63	69
60 minutes	123	117	66	124
90 minutes	171	168	133	152
2 hours	231	188	185	177
3½ hours	386	371	333	326
4¼ hours	433	408	362	311
5 hours	545	520	497	469
8 hours	831	808	804	715
22½ hours	(1)	(1)	(1)	(1)

[1] Complete.

The data in table 14 for pH values above 7 are not as conclusive as the low pH data. The glucose removal at pH values of 7, 8.1, 9.6, and 11.5+ are remarkably similar for the first 2-hour period. Beyond this aeration time there seems to be some slight reduction in the glucose removal values as the pH was increased. At the end of 8 hours the percentage of glucose removal was 83.1, 80.8, 80.4, and 71.5 at pH 7, 8.1, 9.6, and 11.5, respectively. As it seems reasonable to suppose that autocatalytic oxidation of glucose took place at the higher pH values, it is impossible to estimate without further investigation the extent of the damage to the common glucose removal mechanism of the sludge at these high pH values.

GLUCOSE REMOVAL RATES IN ABSENCE OF OXYGEN

The rate of glucose removal during intimate mixing of activated sludge and glucose substrate in the absence of dissolved oxygen was studied in several experiments. In one test, four equal portions of activated sludge were each given 1,000 p. p. m. of glucose using different methods of keeping the sludge particles and glucose substrate in intimate contact. One portion, A, was aerated in the ordinary way using about 4 to 5 cu. ft. of air per hour for 3 liters of aeration mixture. This method kept the mixture aerobic at all times and also intimately mixed the sludge particles with the substrate. The second portion, B, was stirred with a paddle sufficiently to keep the sludge particles in complete suspension and about as intimately mixed as the particles in portion A. Although a layer of oil was placed on the surface of the liquor, this layer tended to gather in the center of the rotating liquid surface so that there undoubtedly was some surface aeration in this portion. However, the surface aeration obtained in this way was very limited and was insufficient in view of the high oxygen demand of the sludge mixture to maintain aerobic conditions throughout the liquid. Portion C was agitated with

nitrogen gas using about 4 to 5 cu. ft. per hour for a 3-liter volume of sludge mixture in the same way that air was used in portion A. The sludge particles were as intimately mixed with the substrate as in portion A, but in this case there was no opportunity for reaeration and the sludge liquor became devoid of oxygen within a few minutes after the start of the experiment. Portion D, which was rotated continuously end over end in a number of completely filled glass-stoppered bottles, also became devoid of oxygen within a few minutes after the start, but the sludge particles may not have been kept in such intimate contact with the glucose substrate because of the slow rotation employed (1 r. p. m).

The results given in table 15 show a very decided difference in the rate of glucose removal obtained with aeration and with other means of agitation in the absence of oxygen. In portion A, with dissolved oxygen maintained by aeration, all of the glucose was removed from solution in 2 hours. Without oxygen the rate of glucose removal was reduced within 15 minutes. After about 2 hours the rate of removal was further reduced to such an extent that about 141, 343, and 360 p. p. m. of glucose remained in solution after 22½ hours of agitation in portions B, C, and D, respectively. It is also interesting to note that in portions C and D, in which all possibility of obtaining dissolved oxygen by reaeration during the agitation was removed, the lowest rates of glucose removal were obtained, while in portion B, where some slight reoxygenation was possible, slightly higher rates of glucose removal were obtained. A repetition of this experiment produced similar results. After 24 hours of mixing, one of the portions agitated without oxygen still contained 254 p. p. m. of glucose. This portion was agitated for an additional hour without any further loss of glucose. It was then aerated for 1 hour and 64 p. p. m. of glucose were removed. These experiments suggest that the organisms in the activated sludge process which are responsible for the glucose removal and dissimilation behave as obligate aerobes. From this it may be inferred that the hydrogen activation in the glucose molecule in this reaction is such that only oxygen will act as a hydrogen acceptor Or, if the theory holds that the oxygen is also activated, the predominant organisms in activated sludge require and activate oxygen for the completion of this reaction. In any case, the velocity of the glucose removal reaction under aeration and the reduction in velocity of the reaction in the absence of air indicate the importance of oxygen to the predominant organisms in this process and confirm both Smit's (*31*) and Heukelekian's (*22*) glucose removal data.

EFFECT OF PROLONGED REAERATION

The effect of prolonged reaeration, without feeding, of activated sludge upon glucose removal was investigated, and the results are given in table 16. These data indicate that prolonged reaeration,

which is, in effect, starvation, steadily reduced the ability of the sludge to remove glucose at a rapid rate. The sludge of this experiment after 18 hours of reaeration removed 40 percent of the glucose feed in 5 hours, but after about 13 days of reaeration it removed only about 11 percent of the same glucose dose in the same time.

TABLE 15.—*Comparison of glucose removal by activated sludge using various methods for keeping the sludge particles and substrate in intimate contact*

Sludge portion	A	B	C	D
Means of keeping sludge and substrate in contact	Aeration with air	Stirring with paddle [1]	Agitation with nitrogen gas [2]	By mechanical rotation of completely filled bottle [3]
Aeration time				
Initial after mixing	48	82	68	24
15 minutes	360	179	121	87
30 minutes	430	221	180	134
45 minutes	552	313	211	239
60 minutes	635	330	273	314
90 minutes	[illegible]	374	355	392
2 hours	(4)	466	418	426
3 hours	----------	557	[illegible]	461
4 hours	----------	601	469	----------
4½ hours	----------	614	----------	----------
22½ hours	----------	859	637	610

[1] The surface of this portion was covered with an oil film. Each sample was removed by siphoning to prevent reaeration during sampling.
[2] Nitrogen gas at the same rate as air in portion A was bubbled through an aerator ball.
[3] 1-liter bottles completely filled were turned over endwise continuously once each minute. A, B, and C were held at room temperature of about 24° C., while D was held at 20° C.
[4] Complete.

TABLE 16.—*Effect of reaeration upon the glucose removal ability of activated sludge*

Reaeration period without feed, hours	18	42	162	306
Sludge solids at start of glucose removal test	2,036	2,054	----------	1,832
Glucose feed, p. p. m.	750	750	750	750
Aeration time, glucose removal test	**Glucose removed, p. p. m.**			
30 minutes	58	33	21	22
60 minutes	80	46	13	11
90 minutes	----------	55	22	22
2 hours	95	12	30	23
3 hours	----------	47	93	30
3½ hours	198	----------	----------	----------
4 hours	----------	----------	105	63
4½ hours	----------	111	----------	----------
5 hours	297	----------	132	87
6 hours	----------	----------	----------	78
6½ hours	----------	283	211	----------

SUPPLEMENTAL FEEDING

Two experiments were carried out to determine the effect of feeding other materials with glucose, upon the glucose removal rate by activated sludge. The results obtained are presented in table 17. The first experiment indicates that the feeding of sewage with glucose increases slightly the rate of glucose removal by activated sludge. The results obtained when peptone was used as a supplemental feed were not as definite as the results with sewage, but this experiment

seems to indicate that peptone certainly does not reduce the glucose removal rate and may increase it very slightly.

TABLE 17.—*Effect of supplemental feeding upon glucose removal by activated sludge*

Experiment	G 13		G 14	
Portion	Control	Supplemental feed	Control	Supplemental feed
Glucose feed, p. p. m.	440	470	445	475
Supplemental feed	0	Domestic sewage	0	Peptone solution (750 p. p. m.)
Aeration time	**Glucose removed, p. p. m.**			
Initial after mixing	51	110		
10 minutes	56	114	78	107
20 minutes	57	115	95	137
30 minutes	82	132	104	99
40 minutes	91	141	114	137
50 minutes	95	144	103	133
60 minutes	116	166	153	173
75 minutes	123	189	159	188
90 minutes	138	206	168	173
2 hours	166	253	202	232
3 hours	208	333	241	256
5 hours	352	430	348	365
23 hours	(1)	(1)	(1)	(1)

[1] Complete.

EFFECT OF REPEATED GLUCOSE FEEDING

After determining the glucose removal rate on a sample of activated sludge, two 8-liter portions of this sludge were treated as follows: One portion was dosed with domestic sewage daily for 9 days and then the glucose removal test was repeated. The second portion was dosed daily with the same sewage as the above portion, but fortified with 500 p. p. m. of glucose. This was continued for 7 days and the glucose removal test was repeated. The results obtained in this experiment are presented in table 18. The glucose removal rate for this sludge was improved slightly after dosing it daily for 9 days with sewage. However, after 1 week of daily treatment with sewage plus 500 p. p. m. of glucose, the glucose removal rate was so accelerated that the time for complete removal was reduced from about 3 hours to 30 minutes. The increase in the suspended solids obtained with glucose fortified sewage in this experiment is quite remarkable. During 9 days of sewage feeding, the quantity of sludge under aeration in the portion fed only with sewage increased by 620 p. p. m. If the proportionate increase of solids due to sewage for 7 days is deducted from the total solids increase in the glucose fortified sewage fed sludge, C, an increase of 2,220 p. p. m. of sludge due to glucose feeding is obtained. As 3,500 p. p. m. of glucose were fed during this interval, the sludge increase due to glucose represents 63 percent of the glucose weight recovered as sludge.

In another experiment, 2,000 p. p. m. of glucose were fed to activated sludge daily for 3 days and the rate of glucose removal was followed each day. The results obtained are given in table 19 and indicate that

in this experiment the sludge was overloaded with respect to glucose. The rate of glucose removal fell upon the second and third feeding. While 86 percent of the glucose was removed in 23 hours in the first day, only 46 percent was removed on the third day in the same time. In this case, additional nitrogenous material in the form of sewage or peptone was not given with the glucose. It is probable that a better performance of the sludge with this quantity of glucose would have been obtained had this been done.

TABLE 18.—*Effect of repeated glucose feeding upon glucose removal by activated sludge using 500 p. p. m. of glucose per day*

Sludge portion	A	B	C
Description	Control (initial sludge)	Same as A except that it was dosed daily with sewage for 9 days	Same as B except that it was dosed daily with same sewage fortified with 500 p. p. m. of glucose for 7 days
Sludge solids change during treatment, p. p. m.:			
From	------------	2,640	2,640
To	------------	3,260	5,340
Sludge solids used in glucose removal test:			
Total suspended p. p. m.	2,610	2,608	2,196
Volatile suspended p. p. m.	1,684	1,608	1,724
Aeration time	**Glucose removed, p. p. m.**		
Initial after mixing	47	100	206
10 minutes	99	163	414
20 minutes	147	221	402
30 minutes	175	261	(1)
45 minutes	209	316	------------
60 minutes	228	360	------------
75 minutes	265	387	------------
90 minutes	295	436	------------
2 hours	356	448	------------
3 hours	458	(1)	------------

[1] Complete.

TABLE 19.—*Effect of feeding 2,000 p. p. m. of glucose daily upon glucose removal by activated sludge*

Aeration time	First day	Second day	Third day
	Suspended solids, p. p. m.		
Initial	2,376	3,314	4,135
1 hour	2,744	3,451	4,063
3 hours	2,608	3,512	------------
5 hours	2,764	3,570	------------
23 hours	3,480	4,145	4,477
	Glucose removal, p. p. m.		
Initial	0	------------	0
15 minutes	44	28	0
30 minutes	79	74	0
45 minutes	99	91	0
60 minutes	111	117	41
90 minutes	205	113	61
2¼ hours	297	120	88
3 hours	340	205	111
4 hours	407	284	135
5 hours	618	373	138
23 hours	1,720	1,176	928

EFFECT OF CHLORINATION

As chlorination is often recommended as a method of controlling or curing the activated sludge process when difficulties are encountered, one experiment to determine the effect of chlorination upon the glucose removal reaction was completed. In this experiment, the desired doses of chlorine, as H. T. H. solution, were added and after 15 minutes of contact any residual chlorine was neutralized with sodium sulfite solution. The glucose solution was then added and the glucose removal tests completed in the ordinary way. The data for this experiment are presented in table 20. It will be seen at once that the 15-minute contact period with 16 p. p. m. of chlorine in portion D practically destroyed the glucose removal mechanism and prevented the removal of glucose for 4 hours. Between the fourth and twenty-first hour of aeration, however, the sludge regained its power to remove glucose. A 6.2 p. p. m. dose of chlorine for 15 minutes also injured the glucose removal mechanism. With this dose only about 109 p. p. m., or 15.6 percent, of the glucose had been removed after 4 hours of aeration. When the values for glucose removal for portions A and B of table 20 are calculated in terms of p. p. m. of glucose removed per gram of sludge, it is found that 1.6 p. p. m. of chlorine affected the glucose removal very slightly. This experiment indicates that the quantity of chlorine that has been suggested by Smith and Purdy (*38*) to correct sludge bulking caused by fungus growths is not great enough to interfere seriously with the ordinary enzymic reactions such as are indicated by the glucose removal mechanism. However, chlorination of activated sludge is attended by the serious danger of overchlorinating. This would destroy not only the plankton growths, as pointed out by the above authors, but also the normal bacterial reactions of the sludge as shown in portion D, in the above experiment.

TABLE 20.—*Effect of chlorination upon glucose removal by activated sludge*

Sludge portion	A	B	C	D
Amount of chlorine, p. p. m., given for 15 minutes and then neutralized	0	1.6	6.2	16.0
Sludge solids, p. p. m.	1,684	1,480	1,412	1,376
Glucose dose, p. p. m.	700	700	700	700
Aeration time	**Glucose removed, p. p. m.**			
Initial after mixing	48	66	8	5
15 minutes	91	98	23	19
30 minutes	152	142	32	0
45 minutes	182	158	44	0
60 minutes	238	192	38	0
75 minutes	270	183	65	0
90 minutes	321	247	31	0
2 hours	380	284	80	0
3 hours	513	404	147	41
4 hours	613	493	109	0
21 hours	(1)	605	606	606

[1] Complete.

SUMMARY AND CONCLUSIONS

The rates of removal of glucose from substrates by activated sludge have been investigated. Experimental data are presented to illustrate the rates of removal of glucose from substrates by normal activated sludge and by pure cultures of certain bacterial species found in activated sludge or domestic sewage. The effect of various factors such as temperature, pH, dissolved oxygen, supplemental feeding and acclimatization on these removal rates has been determined. It has been shown that glucose is removed from solution much more rapidly by activated sludge than by domestic sewage, pure cultures of *Bact. coli*, *Bact. aerogenes*, *Sphaerotilus natans*, or zoogleal sludge. The rate of glucose removal by activated sludge is a function of the quantity of sludge present and, after the first hour, the removal rate follows the Freundlich adsorption equation. A comparison of the rates of removal by activated sludge of glucose and of settled or synthetic sewage indicated that glucose is removed more slowly than the carbonaceous organic matter of settled sewage and more rapidly than the nitrogenous material of synthetic sewage. The zoogleal sludge, however, removed synthetic sewage at a higher rate than glucose.

Temperature studies showed that heating the sludge for 10 minutes at 35° C. did not affect the removal rate, 10 minutes at 45° C. reduced the rate for a considerable time, and 10 minutes at 55° C. practically destroyed the glucose removing mechanism of the sludge. The glucose removal rate roughly doubled for each 10° C. increase in aeration temperature from 0° to 35° C. Aeration temperatures over 45° C. were inimical to glucose removal by activated sludge. Aeration temperatures of the sludge previous to the addition of glucose also affected the glucose removal rate. Winter sludge dosed with glucose and aerated at 27° C. did not remove glucose at as rapid a rate as the summer sludge at this temperature. Summer sludge, to which glucose was added and then aerated at 1° C., removed glucose at higher rates than winter sludge similarly treated. Acclimatization of the sludges at either temperature tended to bring the glucose removal rate to normal for the aeration temperature employed.

Lowering the pH of the sludge for 20 minutes to 5.2 before the addition of glucose retarded glucose removal slightly, and lowering to pH 2.8 for the same time practically destroyed the glucose removing mechanism for several hours. Subjection of the sludge to a pH up to 11 for 30 minutes followed by neutralization had very little effect upon the glucose removal reaction. When activated sludge was aerated below a pH of about 6, the rate of glucose removal was reduced, and at a pH of 3.9 it was practically stopped. The experiments above pH 7 were not conclusive but apparently there was little if any reduction in the glucose removal rate when sludge was aerated at pH values up to 9.6.

The results show definitely that aeration was required to maintain the glucose removal rate. In samples in which the activated sludge was maintained in contact with the glucose substrate by stirring with a paddle, by agitation with nitrogen, or by mechanical rotation of a completely filled bottle, the glucose removal rate was very much reduced within a few minutes. The experiments indicate, however, that while oxygen was needed, the ratio of oxygen used to glucose removed was low.

When glucose was added to sewage or peptone and fed to sludge, these nitrogenous materials did not retard the glucose removal rate and possibly increased it slightly. When glucose alone was fed in large doses, the glucose removal mechanism of the sludge failed after several treatments. This indicated the deficiency of certain nutritive elements, probably nitrogen and phosphorus, for the continued maintenance of the process. When sewage containing glucose was fed regularly to activated sludge for a period of about a week, the rate of glucose removal was very much accelerated. Sludge acclimated in this way can remove 1,000 p. p. m. of glucose from solution in about 90 minutes. This acclimatization phenomenon may be explained upon the basis of a multiplication of certain special glucose removing micro-organisms in the sludge or by the development of adaptive glucose enzymes of the predominant bacteria of the sludge.

Starvation of the sludge by reaeration without additions of food steadily reduced the glucose removal rate. The effect of chlorination on activated sludge depended entirely upon the chlorine dose used. When a mixed liquor containing about 1,500 p. p. m. of suspended sludge solids was dosed with 1.6 p. p. m. of chlorine, the glucose removal reaction was only slightly affected. When the chlorine dose was increased to 6.2 p. p. m. a 75 percent reduction in the glucose removal rate was obtained, and with 15 p. p. m. of chlorine the glucose removal reaction was completely stopped for 4 hours.

The results of this study, using glucose as a representative of the large fraction of organic material present in true solution in sewage, indicate the probability of the rapid removal of such constituents from sewage by the purely biochemical processes in activated sludge and demonstrate the sensitivity of such processes to temperature, proper pH, balanced nutrients, starvation, chlorination, acclimatization, and oxygen depletion. Under the maintenance of proper conditions, such constituents can be removed at rates which compare favorably with the removal of material in suspension from sewage by activated sludge. The metabolism of the glucose removed from solution by the sludge will be considered in a following paper.

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NOTIFIABLE DISEASES IN THE UNITED STATES, 1938

Morbidity and Mortality Summaries for Certain Important Communicable Diseases

The United States Public Health Service has recently issued a tabular morbidity and mortality compilation, by States and by months, for the notifiable diseases as reported by the State health officers in 1938.[1] A summary of this compilation for several important communicable diseases is presented here, together with case and death rates, case fatality rates, and, in some instances, the estimated expectancy based on figures for recent prior years.

For certain diseases, some States do not report cases, or their case reports are manifestly incomplete. In such instances, groups of States with the most satisfactory morbidity reports are treated separately in order to arrive at more nearly accurate case and case-fatality rates, while the totals for the larger group of States include the deaths as cases in States which reported fewer cases than deaths. Case fatality rates are not computed, however, on such totals.

[1] The Notifiable Diseases—Prevalence in States, 1938. Supplement No. 160 to the Public Health Reports. The publication of this information has been held up because of the delay in securing reports from a few States.

The mortality figures may be considered as approximately correct, although they will not agree in all instances with the final figures of the Bureau of the Census.

The estimated expectancy, given for some of the diseases, represents an attempt to ascertain from the experience of recent years the number of cases of a disease that might normally have been expected in 1938.

In comparing the numbers of cases reported in 1938 with the estimated expectancy, or with figures for prior years, it should be borne in mind that there has been a gradual improvement in the reporting of notifiable diseases and that the population has increased. A large increase, however, especially in the case rate, is quite likely to represent an actual increase in the prevalence of the disease.

The populations given for groups of States, used in computing case and death rates, are totals of estimates made for the individual States by the Public Health Service as of July 1, 1938, while the total population of the United States is the estimate of the Bureau of the Census.

CHICKENPOX (44A)*

48 States: [1]	
Cases reported, 1938 (population 130,215,000)	286,848
Estimated expectancy based on years 1931-37	253,896
Cases per 1,000 inhabitants, 1938	2.203
Cases per 1,000 inhabitants, estimated expectancy	2.005
Deaths registered, 1938	104
Deaths per 1,000 inhabitants, 1938	0.001
Cases reported for each death registered, 1938	2,758

DIPHTHERIA (10)

48 States: [1]	
Cases reported, 1938 (population 130,215,000)	30,508
Estimated expectancy based on years 1931-37	42,309
Cases per 1,000 inhabitants, 1938	0.234
Cases per 1,000 inhabitants, estimated expectancy	0.334
Deaths registered, 1938	2,560
Deaths per 1,000 inhabitants, 1938	0.020
Cases reported for each death registered, 1938	12

DYSENTERY (AMOEBIC) (13A)

28 States: [1]	
Cases reported, 1938 (population 97,375,000)	2,490
Cases per 1,000 inhabitants, 1938	0.026
Deaths registered, 1938	224
Deaths per 1,000 inhabitants, 1938	0.002
Cases reported for each death registered, 1938	11
35 States: [1]	
Cases reported, 1938 (population 120,281,000)	[2] 2,538
Deaths registered, 1938	272
Deaths per 1,000 inhabitants, 1938	0.002
47 States: [1]	
Deaths registered, 1938 (population 129,978,000)	274
Deaths per 1,000 inhabitants, 1938	0.002

DYSENTERY (BACILLARY) (13B)

30 States:	
Cases reported, 1938 (population 101,926,000)	20.382
Cases per 1,000 inhabitants, 1938	0.200
Deaths registered, 1938	966
Deaths per 1,000 inhabitants, 1938	0.009
Cases reported for each death registered, 1938	21
42 States: [1]	
Cases reported, 1938 (population 126,668,000)	[2] 20,644
Deaths registered, 1938	1,228
Deaths per 1,000 inhabitants, 1938	0.010
46 States: [1]	
Deaths registered, 1938 (population 128,086,000)	1,263
Deaths per 1,000 inhabitants, 1938	0.010

* Figures in parentheses in the subheadings are disease title numbers from the International List of Causes of Death, 1929.

[1] The District of Columbia is also included but not counted as a State.

[2] Includes the numbers of deaths used as cases when no cases are reported, or when the reported numbers of cases are less than the numbers of deaths.

ENCEPHALITIS, EPIDEMIC OR LETHARGIC (17)

30 States:	
Cases reported, 1938 (population 80,048,000)	983
Cases per 1,000 inhabitants, 1938	0.012
Deaths registered, 1938	467
Deaths per 1,000 inhabitants, 1938	0.006
Cases reported for each death registered, 1938	2.105
45 States: [1]	
Cases reported, 1938 (population 129,338,000)	[2] 1,303
Deaths registered, 1938	787
Deaths per 1,000 inhabitants, 1938	0.006
48 States: [1]	
Deaths registered, 1938 (population 130,215,000)	787
Deaths per 1,000 inhabitants, 1938	0.006

GONORRHEA (35)

48 States: [1]	
Cases reported, 1938 (population 130,215,000)	181,845
Cases per 1,000 inhabitants, 1938	1.396

INFLUENZA (11)

35 States: [1]	
Cases reported, 1938 (population 81,053,000)	128,736
Cases per 1,000 inhabitants, 1938	1.588
Deaths registered, 1938	12,568
Deaths per 1,000 inhabitants, 1938	0.155
Cases reported for each death registered, 1938	10.243
48 States: [1]	
Cases reported, 1938 (population 130,215,000)	[2] 132,954
Deaths registered, 1938	16,778
Deaths per 1,000 inhabitants, 1938	0.129

MALARIA (38)

36 States:	
Cases reported, 1938 (population 120,024,000)	84,204
Cases per 1,000 inhabitants, 1938	0.702
Deaths registered, 1938	2,305
Deaths per 1,000 inhabitants, 1938	0.019
Cases reported for each death registered, 1938	37
38 States:	
Cases reported, 1938	[2] 84,206
48 States: [1]	
Deaths registered, 1938 (population 130,215,000)	2,307
Deaths per 1,000 inhabitants, 1938	0.018

MEASLES (7)

48 States: [1]	
Cases reported, 1938 (population 130,215,000)	822,811
Cases per 1,000 inhabitants, 1938	6.319
Deaths registered, 1938	3,227
Deaths per 1,000 inhabitants, 1938	0.025
Cases reported for each death registered, 1938	255

MENINGITIS, MENINGOCOCCUS (18)

44 States: [1]	
Cases reported, 1938 (population 122,749,000)	2,788
Estimated expectancy based on years 1931–37	4,095
Cases per 1,000 inhabitants, 1938	0.023
Cases per 1,000 inhabitants, estimated expectancy	0.034
Deaths registered, 1938	960
Deaths per 1,000 inhabitants, 1938	0.008
Cases reported for each death registered, 1938	2.904
47 States: [1]	
Cases reported, 1938 (population 128,323,000)	[2] 2,919
Deaths registered, 1938	1,001
Deaths per 1,000 inhabitants, 1938	0.009
48 States: [1]	
Deaths registered, 1938 (population 130,215,000)	1,106
Deaths per 1,000 inhabitants, 1938	0.008

MUMPS (PART 44C)

44 States:	
Cases reported, 1938 (population 108,492,000)	152,749
Estimated expectancy based on years 1931–37	109,904
Cases per 1,000 inhabitants, 1938	1.408
Cases per 1,000 inhabitants, estimated expectancy	1.043
Deaths registered, 1938	57
Deaths per 1,000 inhabitants, 1938	0.0005
Cases reported for each death registered, 1938	2,680
47 States: [1]	
Cases reported, 1938	[2] 153,967
Deaths registered, 1938 (population 128,323,000)	68
Deaths per 1,000 inhabitants, 1938	0.0005

[1] The District of Columbia is also included but not counted as a State.
[2] Includes the numbers of deaths used as cases when no cases are reported, or when the reported numbers of cases are less than the numbers of deaths.

PELLAGRA (62)

21 States: [1]	
Cases reported, 1938 (population 55,325,000)	14,676
Cases per 1,000 inhabitants, 1938	0.265
Deaths registered, 1938	3,053
Deaths per 1,000 inhabitants, 1938	0.055
Cases reported for each death registered, 1938	4.807
37 States: [1]	
Cases reported, 1938 (population 124,731,000)	[2] 14,799
Deaths registered, 1938	3,176
Deaths per 1,000 inhabitants, 1938	0.025
48 States: [1]	
Deaths registered, 1938 (population 130,215,000)	3,176
Deaths per 1,000 inhabitants, 1938	0.024

PNEUMONIA (ALL FORMS) (107–109)

22 States: [1]	
Cases reported, 1938 (population 61,621,000)	96,927
Cases per 1,000 inhabitants, 1938	1.573
Deaths registered, 1938	41,885
Deaths per 1,000 inhabitants, 1938	0.680
Cases reported for each death registered, 1938	2.314
48 States: [1]	
Cases reported, 1938 (population 130,215,000)	[2] [3] 143,997
Deaths registered, 1938	87,867
Deaths per 1,000 inhabitants, 1938	0.675

POLIOMYELITIS (16)

47 States: [1]	
Cases reported, 1938 (population 130,113,000)	1,705
Estimated expectancy based on years 1931–37	4,553
Cases per 1,000 inhabitants, 1938	0.013
Cases per 1,000 inhabitants, estimated expectancy	0.036
Deaths registered, 1938	478
Deaths per 1,000 inhabitants, 1938	0.004
Cases reported for each death registered, 1938	3.567
48 States: [1]	
Deaths registered, 1938 (population 130,215,000)	478
Deaths per 1,000 inhabitants, 1938	0.004

SCARLET FEVER (5)

48 States: [1]	
Cases reported, 1938 (population 130,215,000)	189,631
Estimated expectancy based on years 1931–37	211,057
Cases per 1,000 inhabitants, 1938	1.456
Cases per 1,000 inhabitants, estimated expectancy	1.667
Deaths registered, 1938	1,216
Deaths per 1,000 inhabitants, 1938	0.009
Cases reported for each death registered, 1938	156

SEPTIC SORE THROAT (115A)

31 States:	
Cases reported, 1938 (population 79,007,000)	7,205
Cases per 1,000 inhabitants, 1938	0.091
Deaths registered, 1938	1,009
Deaths per 1,000 inhabitants, 1938	0.013
Cases reported for each death registered, 1938	7.141
46 States: [1]	
Cases reported, 1938	[2] 9,445
44 States: [1]	
Deaths registered, 1938 (population 112,586,000)	1,927
Deaths per 1,000 inhabitants, 1938	0.014

SMALLPOX (6)

48 States: [1]	
Cases reported, 1938 (population 130,215,000)	49,319
Estimated expectancy based on years 1931–37	7,300
Cases per 1,000 inhabitants, 1938	0.115
Cases per 1,000 inhabitants, estimated expectancy	0.058
Deaths registered, 1938	46
Deaths per 1,000 inhabitants, 1938	0.0004
Cases reported for each death registered, 1938	325

SYPHILIS (34)

48 States: [1]	
Cases reported, 1938 (population 130,215,000)	476,702
Cases per 1,000 inhabitants, 1938	3.661

TUBERCULOSIS (ALL FORMS) (23–32)

37 States:	
Cases reported, 1938 (population 106,136,000)	95,383
Cases per 1,000 inhabitants, 1938	0.899
Deaths registered, 1938	49,696
Deaths per 1,000 inhabitants, 1938	0.468
Cases reported for each death registered, 1938	1.919
44 States: [1]	
Cases reported, 1938	[2] 104,964
48 States: [1]	
Deaths registered, 1938 (population 130,215,000)	63,155
Deaths per 1,000 inhabitants, 1938	0.485

[1] The District of Columbia is also included but not counted as a State.
[2] Includes the numbers of deaths used as cases when no cases are reported, or when the reported numbers of cases are less than the numbers of deaths.
[3] Includes 4,296 cases of lobar pneumonia only, reported in Massachusetts.

TUBERCULOSIS (RESPIRATORY SYSTEM) (23)

19 States:	
Cases reported, 1938 (population 51,673,000)	47,107
Cases per 1,000 inhabitants, 1938	0.912
Deaths registered, 1938	23,000
Deaths per 1,000 inhabitants, 1938	0.445
Cases reported for each death registered, 1938	2.048
47 States:[1]	
Cases reported, 1938 (population 129,797,000)	[2] 80,899
Deaths registered, 1938	56,792
Deaths per 1,000 inhabitants, 1938	0.438

TYPHOID FEVER (1) AND PARATYPHOID FEVER (2)

48 States:[1]	
Cases reported, 1938 (population 130,215,000)	14,903
Estimated expectancy based on years 1931-37	20,282
Cases per 1,000 inhabitants, 1938	0.114
Cases per 1,000 inhabitants, estimated expectancy	0.160
Deaths registered, 1938	2,397
Deaths per 1,000 inhabitants, 1938	0.018
Cases reported for each death registered, 1938	6.217

WHOOPING COUGH (9)

48 States:[1]	
Cases reported, 1938 (population 130,215,000)	227,319
Estimated expectancy based on years 1931-37	189,549
Cases per 1,000 inhabitants, 1938	1.746
Cases per 1,000 inhabitants, estimated expectancy	1.497
Deaths registered, 1938	4,729
Deaths per 1,000 inhabitants, 1938	0.036
Cases reported for each death registered, 1938	48

[1] The District of Columbia is also included but not counted as a state.
[2] Includes the numbers of deaths used as cases when no cases are reported, or when the reported number of cases are less than the number of deaths.

Cases reported, 1938, by months

Disease	Number of States [1]	January	February	March	April	May	June	July	August	September	October	November	December	Total
Anthrax in man (20)	20	7	4	3	2	3	2	6	5	8	5	4	5	[2] 54
Chickenpox (44a)	48	44,133	39,840	44,793	34,205	25,522	19,425	6,015	1,954	2,448	11,726	24,852	31,935	286,848
Dengue (part 44c)	8	39	42	13	15	12	34	35	14	12	24	9	11	[2] 260
Diphtheria (10)	48	3,032	2,491	2,198	1,713	1,427	1,312	1,343	1,752	2,847	4,930	4,061	3,352	30,508
Dysentery (amoebic) (13a)	35	98	136	147	185	237	294	295	284	217	229	201	185	[2] 2,538
Dysentery (bacillary) (13b)	42	501	410	426	1,028	3,168	4,631	3,388	2,733	1,847	1,033	848	631	[2] 20,644
Dysentery (unspecified)	5	45	32	37	55	32	49	82	78	108	48	57	50	[3] 674
Encephalitis, epidemic or lethargic (17)	45	73	84	84	83	74	83	93	181	271	113	73	91	[2] 1,303
Influenza (11)	48	26,848	26,490	16,724	10,318	5,318	3,525	3,101	3,233	4,333	7,227	8,991	16,790	[2] [3] 132,954
Malaria (38)	38	1,863	1,917	2,490	4,008	6,014	8,898	11,704	14,063	14,521	10,957	4,734	2,437	[2] 84,206
Measles (7)	48	89,450	142,318	196,351	156,717	106,909	66,961	17,320	4,764	2,824	5,386	11,138	22,595	[3] 822,811
Meningitis meningococcus (18)	47	403	384	366	312	250	216	160	162	140	170	146	210	[2] 2,919
Mumps (part 44c)	47	18,549	20,462	28,141	23,186	17,821	12,805	4,998	2,867	2,574	4,569	7,538	10,457	[2] 153,967
Pellagra (62)	37	578	639	1,016	1,288	1,956	2,478	2,210	1,403	1,051	892	696	592	[2] 14,799
Pneumonia (all forms) (107-109)	48	21,104	19,173	18,569	14,509	10,416	8,854	5,533	4,857	5,640	8,780	10,366	15,723	[2] [3] [4] 143,997
Poliomyelitis (16)	47	102	87	90	69	66	129	199	334	261	178	91	99	1,705
Rabies in animals	28	620	632	676	629	620	584	470	439	366	457	520	512	[5] 6,425
Rabies in man (deaths) (21)	48	5	7	5	8	9	2	4	9	3	9	4	6	71
Rocky Mountain spotted fever (part 44c)	32	2	--------	4	26	63	88	118	71	26	14	6	6	[3] 434
Scarlet fever (8)	48	26,054	24,970	28,433	22,829	17,596	10,932	4,634	3,375	5,541	12,010	14,640	18,617	189,631
Septic sore throat (115a)	46	1,002	861	1,150	1,019	828	629	580	615	514	638	735	874	[2] 9,445
Smallpox (6)	48	2,707	2,324	2,184	2,174	1,546	1,320	689	224	187	234	438	912	14,939
Tuberculosis (all forms) (23-32)	44	8,072	7,773	9,623	9,556	9,316	9,685	9,406	8,885	8,278	8,346	7,728	8,296	[2] 104,964
Tuberculosis (respiratory system) (23)	47	6,692	6,120	7,470	7,334	7,166	7,611	6,750	6,861	6,262	6,373	6,118	6,142	[2] 80,899
Tularaemia (part 44c)	40	140	51	66	72	70	91	96	65	55	42	203	1,137	2,088
Typhoid fever and paratyphoid fever (1) (2)	48	524	526	563	623	814	1,465	2,351	2,678	2,288	1,529	902	638	[3] 14,903
Typhus fever (3)	21	129	76	65	64	110	152	270	200	296	313	237	231	[3] 2,294
Undulant fever (5)	47	252	310	328	340	357	386	458	392	418	488	320	330	4,379
Venereal diseases:														
Gonorrhea (35)	48	14,829	14,534	15,435	14,672	12,886	14,847	15,555	16,769	16,926	16,922	14,653	13,817	181,845
Syphilis (34)	48	32,903	35,444	42,871	46,492	35,956	40,120	39,225	41,014	40,170	45,155	40,104	37,248	476,702
Whooping cough (9)	48	18,457	17,498	21,272	21,668	21,311	21,414	21,654	19,866	14,823	14,128	17,268	17,960	227,319

[1] The District of Columbia is also included but not counted as a State.
[2] Includes the numbers of deaths used as cases when no cases are reported, or when the reported numbers of cases are less than the numbers of deaths.
[3] The following numbers of cases of certain diseases are not distributed by months but are included in the totals of the above table: Dysentery (unspecified) 1; influenza, 66; measles, 6; pneumonia (all forms), 383; Rocky Mountain spotted fever, 10; typhoid and paratyphoid fever, 2; typhus fever, 61.
[4] Includes 4,296 cases of lobar pneumonia only reported in Massachusetts.
[5] Exclusive of New York City.

NOTE.—Figures in parentheses are disease title numbers from the International List of Causes of Death, 1929.

Deaths registered, 1938, by months

Disease	Number of States [1]	January	February	March	April	May	June	July	August	September	October	November	December	Total
Anthrax in man (20)	48	----	----	1	1	2	----	2	1	1	----	----	2	10
Chickenpox (44a)	48	13	10	18	11	6	9	2	3	2	6	14	10	104
Dengue (part 44c)	48	1	1	----	----	1	3	3	1	1	----	----	----	11
Diphtheria (10)	48	275	210	172	125	116	87	111	129	239	367	399	326	[2] 2,560
Dysentery (amoebic) (13a)	47	23	12	20	15	25	28	34	37	25	18	16	21	[3] 274
Dysentery (bacillary) (13b)	46	30	23	27	60	140	265	179	171	151	108	70	39	[3] 1,263
Encephalitis, epidemic or lethargic (17)	48	64	61	63	60	73	61	60	81	102	59	49	54	787
Influenza (11)	48	3,035	2,683	2,515	1,471	1,005	525	438	435	495	922	1,173	2,015	[2] 16,778
Malaria (38)	48	79	54	82	100	135	182	304	389	367	332	172	111	2,307
Measles (7)	48	250	436	716	666	521	279	140	52	32	21	35	75	[2] 3,227
Meningitis, meningococcus (18)	48	162	145	130	104	87	73	59	57	52	74	82	80	[2] 1,106
Mumps (part 44c)	47	7	9	6	9	7	6	7	3	6	1	3	3	[2] 68
Pellagra (62)	48	223	222	241	259	302	372	342	273	235	234	227	246	3,176
Pneumonia (all forms) (107-109)	48	12,742	10,894	10,855	8,433	6,248	4,457	3,481	3,447	4,070	5,754	6,844	10,259	[2] 87,867
Poliomyelitis (16)	48	44	34	37	37	34	38	44	45	51	32	41	41	478
Rabies in man (21)	48	5	7	5	8	9	2	4	9	3	9	4	6	71
Rocky Mountain spotted fever (part 44c)	48	----	----	1	8	14	21	28	23	7	1	1	----	104
Scarlet fever (8)	48	184	160	169	140	95	61	42	48	48	76	84	104	[2] 1,216
Septic sore throat (115a)	45	181	175	183	183	190	141	137	132	127	138	152	185	1,924
Smallpox (6)	48	9	3	5	5	8	8	4	----	----	2	----	2	46
Tuberculosis (all forms) (23-32)	48	5,595	5,158	5,757	5,772	5,736	5,243	5,307	4,970	4,790	4,964	4,725	4,990	[2] 63,155
Tuberculosis (respiratory system) (23)	47	5,069	4,647	5,210	5,147	5,111	4,784	4,704	4,441	4,280	4,491	4,302	4,476	[2] 56,792
Tularaemia (part 44c)	48	11	4	1	5	7	7	6	3	3	2	24	66	139
Typhoid fever and paratyphoid fever (1) (2)	48	129	101	119	107	157	227	323	367	316	267	144	135	[2] 2,397
Typhus fever (3)	48	6	3	6	5	12	12	28	10	16	20	10	9	137
Undulant fever (5)	48	12	5	9	5	13	4	11	16	13	15	5	10	118
Whooping cough (9)	48	324	425	485	504	533	481	485	347	331	276	261	264	[2] 4,729

[1] The District of Columbia is also included but not counted as a State.

[2] The following numbers of deaths from certain diseases are not distributed by months but are included in the totals of the above table: Diphtheria, 4; influenza, 66; measles, 4; meningitis, meningococcus, 1; mumps, 1; pneumonia (all forms), 383; scarlet fever, 5; tuberculosis (all forms), 148; tuberculosis (respiratory system), 130; typhoid fever and paratyphoid fever, 5; whooping cough, 13.

[3] Exclusive of 25 deaths from dysentery, unspecified, reported as follows: New Hampshire, 1; Pennsylvania, 23; Wyoming, 1.

NOTE.—Figures in parentheses are disease title numbers from the International List of Causes of Death, 1929.

THE FIRST UNITED STATES CENSUS OF HOUSING

The first comprehensive data on housing in the United States will be secured in conjunction with the 1940 census which is to be conducted by the United States Bureau of the Census in April of this year.

In view of the intimate relationship between housing conditions and health, the information covering the entire country that will be made available by this part of the coming census will be of great value to health departments and social workers as well as to housing authorities, other governmental agencies, and commercial interests. By correlating the data secured in this census with information regarding sickness and death and with the incidence of specific diseases, the relationship between conditions of housing and health can be better established and the housing program more definitely determined with respect to human needs.

There are 31 questions on housing to be asked by the enumerators. These questions fall under 4 general headings, as follows:

1. Characteristics of structures in which the dwelling unit is located.
2. Characteristics of dwelling units.
3. Characteristics of occupied dwelling unit.
4. Mortgage characteristics of owner-occupied nonfarm 1- to 4-family structures.

The first three of these headings will contain questions which will provide information of especial interest to health and social workers, such as physical condition of structure and number of dwelling units contained, number of rooms, number of persons in household, water supply, toilet and bathing facilities, lighting, heating, and refrigeration.

The Senate Committee on Education and Labor of the United States Housing Act sums up the estimated extent of the housing problem in the United States by the following statement:

> It is now a matter of general agreement that even before the depression commenced over 10,0C0,000 families in America, or more than 40,000,000 people, were subjected to housing conditions that did not adequately protect their health and safety.

This quest for information that will be most helpful in disease prevention as well as in all human betterment programs deserves the unqualified support of all health and social agencies as well as of all individuals. Health departments and housing authorities may help in securing this aid and cooperation through educational publicity. The concerns and programs of these agencies meet on a common basis in the need for full information regarding housing conditions that affect adversely the health, lives, and comfort of the people of the United States.

DEATHS DURING WEEK ENDED FEBRUARY 17, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Feb. 17, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,751	9,939
Average for 3 prior years	9,744	
Total deaths, first 7 weeks of year	67,941	65,444
Deaths under 1 year of age	534	580
Average for 3 prior years	587	
Deaths under 1 year of age, first 7 weeks of year	3,843	3,844
Data from industrial insurance companies:		
Policies in force	66,256,632	68,049,622
Number of death claims	12,586	11,890
Death claims per 1,000 policies in force, annual rate	9.9	9.1
Death claims per 1,000 policies, first 7 weeks of year, annual rate	10.4	10.1

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MARCH 2, 1940

Summary

The decline in influenza continued, with 11,533 cases reported for the current week as compared with 13,950 cases for the preceding week. The figures for the current week do not include a cumulative delayed report of 10,035 cases which the State health officer of Indiana reported to have occurred in Madison County since the first of the year and not previously recorded. It was stated that there had been an outbreak in that county, during which the schools in some localities had been temporarily closed. The distribution of these cases by weeks is not available.

All geographic areas which have been reporting a considerable number of cases, except the East North Central States, showed a decline. The increase of 208 cases in that group of States was accounted for entirely by the increase in Ohio, which reported 253 cases for the current week.

All the other 8 important communicable diseases included in the weekly telegraphic reports were below the median expectancy, based on reports for the 5-year period 1935–39. For the first time in 1940 the weekly number of cases of poliomyelitis dropped below the 5-year median. The cumulated totals for the first 9 weeks of this year are well below the median 5-year totals for the corresponding period for all 9 diseases except influenza and poliomyelitis. The current 8 weeks' total for measles is less than half, for meningitis about one-third, for smallpox about one-fourth, and for typhoid fever a little more than half the 5-year median.

For the current week, 23 cases of endemic typhus fever were reported, 9 of which occurred in Georgia.

Telegraphic morbidity reports from State health officers for the week ended March 2, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 2, 1940	Mar. 4, 1939		Mar. 2, 1940	Mar. 4, 1939		Mar. 2, 1940	Mar. 4, 1939		Mar. 2, 1940	Mar. 4, 1939	
NEW ENG.												
Maine	1	6	2	3	46	15	336	10	165	0	0	0
New Hampshire	0	0	0	------	------	------	23	9	13	0	0	0
Vermont	0	0	1	------	------	------	11	23	23	0	0	0
Massachusetts	3	5	5	------	------	------	329	1,061	916	4	2	3
Rhode Island	0	0	1	------	------	------	183	14	43	0	0	0
Connecticut	4	0	4	7	30	21	150	490	490	0	0	1
MID. ATL.												
New York	18	23	34	[1] 68	[1] 91	[1] 56	468	1,224	1,848	1	6	13
New Jersey	7	10	14	29	24	29	73	45	842	1	0	3
Pennsylvania	28	38	41	------	------	------	254	182	797	12	6	6
E. NO. CEN.												
Ohio	12	48	35	253	------	103	28	31	421	3	3	9
Indiana [2]	12	17	27	52	607	89	23	23	40	1	0	1
Illinois	18	32	41	52	1,241	71	30	23	32	2	1	7
Michigan [3]	1	12	12	20	429	10	213	320	320	1	0	2
Wisconsin	5	0	2	173	584	120	233	1,086	1,086	0	0	2
W. NO. CEN.												
Minnesota	8	3	3	3	12	5	253	1,120	289	0	0	2
Iowa	8	4	5	65	1,083	27	309	102	54	0	0	1
Missouri	19	25	20	32	644	382	54	14	20	1	2	3
North Dakota	2	0	1	44	364	12	11	215	8	0	0	0
South Dakota	1	4	2	1	77	2	0	280	3	0	0	1
Nebraska	0	0	8	------	2	---	49	42	29	0	1	2
Kansas	5	1	13	41	116	32	639	10	12	0	1	2
SO. ATL.												
Delaware	0	2	2	------	------	------	1	0	26	0	0	0
Maryland [3]	4	5	9	55	124	72	2	1,077	146	1	0	4
Dist. of Col.	7	7	7	4	25	3	2	19	19	0	2	2
Virginia	12	16	16	1,690	1,509	------	30	252	252	0	0	5
West Virginia [3]	8	7	12	1,500	271	236	9	13	38	1	0	2
North Carolina [4]	13	14	19	52	97	174	183	1,563	787	2	2	5
South Carolina	5	12	6	945	1,181	1,181	6	27	33	0	1	1
Georgia [4]	13	2	6	590	140	304	94	153	.	3	0	1
Florida	10	5	5	9	9	33	68	188	102	0	0	2
E. SO. CEN.												
Kentucky	8	7	15	107	1,348	117	32	56	121	1	3	6
Tennessee [4]	4	8	10	231	146	175	78	80	52	2	1	6
Alabama [5]	6	8	15	528	599	889	224	228	228	1	1	2
Mississippi [3]	8	4	4	------	------	------	------	------	------	0	0	0
W. SO. CEN.												
Arkansas	2	7	3	838	1,473	184	17	76	58	0	0	0
Louisiana [4]	3	8	14	194	30	37	12	183	51	3	0	1
Oklahoma	6	9	10	443	334	256	3	148	54	0	0	2
Texas [4]	23	40	45	2,547	965	897	465	330	418	1	4	5
MOUNTAIN												
Montana	0	0	1	4	126	45	22	363	62	0	0	1
Idaho	0	1	0	1	1	3	96	79	28	0	0	0
Wyoming	0	6	0	------	1	------	57	119	17	1	0	0
Colorado	7	8	8	25	150	------	25	98	98	0	1	1
New Mexico	0	1	5	2	57	30	4	38	38	0	0	1
Arizona	3	5	5	280	144	144	25	31	31	0	2	1
Utah [3]	3	1	1	17	53	------	341	130	24	0	0	0
PACIFIC												
Washington	0	4	4	4	8	4	776	352	132	1	0	1
Oregon	8	1	1	38	97	109	446	60	60	0	0	0
California	21	45	33	580	50	202	462	3,845	564	1	5	5
Total	821	456	548	11,533	14,288	11,515	7,149	15,922	15,922	44	44	154
9 weeks	[6] 3,716	4,939	5,803	[6] 124,174	51,047	51,047	44,809	106,124	106,124	351	481	987

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 2, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 2, 1940	Mar. 4, 1939		Mar. 2, 1940	Mar. 4, 1939		Mar. 2, 1940	Mar. 4, 1939		Mar. 2, 1940	Mar. 4, 1939	
NEW ENG.												
Maine	0	0	0	3	27	21	0	0	0	0	1	1
New Hampshire	0	0	0	3	4	13	0	0	0	0	0	0
Vermont	0	0	0	2	9	13	0	0	0	0	0	1
Massachusetts	0	0	0	135	229	229	0	0	0	1	0	1
Rhode Island	0	0	0	15	12	18	0	0	0	0	0	0
Connecticut	0	0	0	82	98	90	0	0	0	1	0	0
MID. ATL.												
New York	2	1	1	835	638	948	0	0	0	1	5	5
New Jersey	0	0	0	425	196	196	0	0	0	0	2	2
Pennsylvania	0	1	1	389	404	608	0	0	0	9	4	3
E. NO. CEN.												
Ohio	1	0	0	436	646	491	1	22	8	3	2	2
Indiana [3]	0	1	1	168	204	246	1	86	4	1	2	3
Illinois	1	1	1	703	516	707	4	15	12	3	1	2
Michigan [3]	0	0	0	414	469	469	4	13	1	1	1	1
Wisconsin	8	0	0	136	283	333	13	5	9	0	0	0
W. NO. CEN.												
Minnesota	0	0	0	118	111	149	5	12	12	0	0	0
Iowa	0	0	0	65	126	126	4	37	20	1	0	0
Missouri	0	0	0	101	125	219	4	6	17	7	1	2
North Dakota	0	0	0	17	15	50	0	3	8	0	0	0
South Dakota	0	0	0	14	23	24	0	11	11	0	0	0
Nebraska	0	0	0	19	41	66	0	14	14	0	0	0
Kansas	0	0	0	83	154	217	2	4	28	0	0	0
SO. ATL.												
Delaware	0	0	0	7	0	10	0	0	0	0	0	0
Maryland [3]	0	0	0	43	47	73	0	0	0	2	0	2
Dist. of Col	0	0	0	26	20	25	0	0	0	0	1	0
Virginia	0	0	1	32	40	40	0	0	0	1	8	2
West Virginia [3]	0	2	0	53	40	45	1	0	0	0	6	3
North Carolina [4]	0	0	1	45	32	37	1	0	0	0	3	1
South Carolina	1	0	0	1	5	5	1	0	0	1	1	1
Georgia [4]	0	0	0	25	13	7	0	0	1	1	4	3
Florida	0	0	0	13	18	5	0	0	0	1	6	2
E. SO. CEN.												
Kentucky	0	0	0	88	68	68	0	4	0	2	5	5
Tennessee [4]	0	0	0	77	53	28	4	7	0	4	0	1
Alabama [5]	0	1	1	18	21	15	0	0	0	1	1	2
Mississippi [3]	1	0	0	8	7	9	0	0	0	0	3	1
W. SO. CEN.												
Arkansas	0	0	0	6	9	9	2	1	1	0	1	1
Louisiana [4]	0	1	0	11	6	11	0	0	1	1	54	7
Oklahoma	0	0	0	13	45	39	1	55	8	1	1	2
Texas [4]	2	0	1	67	89	89	5	25	7	5	20	7
MOUNTAIN												
Montana	0	0	0	33	27	31	0	3	8	0	0	0
Idaho	0	1	1	20	18	18	0	16	4	0	1	0
Wyoming	0	0	0	6	2	37	0	0	1	1	1	0
Colorado	0	0	0	66	24	73	11	0	2	1	2	2
New Mexico		1	0	17	27	27	1	0	0	0	4	4
Arizona	0	0	0	14	10	10	1	6	0	1	0	0
Utah [3]	0	0	0	24	42	54	0	0	0	0	0	0
PACIFIC												
Washington	0	0	0	64	63	63	0	4	11	2	2	1
Oregon	0	0	0	32	47	47	1	9	9	0	0	0
California	4	2	3	175	285	285	0	88	12	0	3	3
Total	15	12	18	5,147	5,398	7,153	67	396	293	53	146	100
9 weeks	275	145	192	[5]40,913	48,148	57,724	640	3,597	2,657	674	1,037	1,037

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 2, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough	
	Week ended	
	Mar. 2, 1940	Mar. 4, 1939
NEW ENG.		
Maine	46	64
New Hampshire	0	0
Vermont	70	35
Massachusetts	119	229
Rhode Island	19	96
Connecticut	63	77
MID. ATL.		
New York	492	491
New Jersey	84	578
Pennsylvania	341	282
E. NO. CEN.		
Ohio	156	159
Indiana	33	14
Illinois	110	269
Michigan [3]	153	206
Wisconsin	130	273
W. NO. CEN.		
Minnesota	28	35
Iowa	7	19
Missouri	11	48
North Dakota	13	13
South Dakota	1	6
Nebraska	4	8
Kansas	36	22
SO. ATL.		
Delaware	8	2
Maryland [3]	207	23
Dist. of Col	6	17
Virginia	45	67
West Virginia [3]	42	21
North Carolina [4]	138	211
SO. ATL.—continued		
South Carolina	22	106
Georgia [4]	11	12
Florida	4	81
E. SO. CEN.		
Kentucky	52	10
Tennessee [4]	31	41
Alabama [5]	12	51
Mississippi [3]	----------	----------
W. SO. CEN.		
Arkansas	1	17
Louisiana [4]	28	1
Oklahoma	5	6
Texas [4]	154	96
MOUNTAIN		
Montana	10	7
Idaho	8	0
Wyoming	12	1
Colorado	11	35
New Mexico	71	45
Arizona	28	19
Utah [3]	117	51
PACIFIC		
Washington	24	32
Oregon	44	13
California	167	162
Total	3,174	3,999
9 weeks	25,267	38,184

[1] New York City only.
[2] An estimate has been reported of approximately 10,000 additional cases of influenza in Madison County since about the first of the year.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended Mar. 2, 1940, 23 cases, as follows: North Carolina, 2; South Carolina, 1; Georgia, 9; Tennessee, 3; Louisiana, 1; Texas, 7.
[5] Later information increases to 8, 912, and 15, respectively, the reported cases of diphtheria, influenza, and scarlet fever in Alabama for the week ended Feb. 17, 1940. See PUBLIC HEALTH REPORTS, Feb. 23, 1940, pp. 335 and 336.

WEEKLY REPORTS FROM CITIES

City reports for week ended February 17, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	176	1,124	146	5,558	975	2,091	36	398	18	1,137	--------
Current week	96	1,090	135	1,245	769	1,584	1	360	13	667	--------
Maine:											
Portland	0	------	0	12	3	0	0	0	0	9	26
New Hampshire:											
Concord	0	------	0	0	1	0	0	0	0	0	9
Manchester	0	------	1	0	0	1	0	0	0	0	22
Nashua	0	------	0	54	0	1	0	0	0	0	5
Vermont:											
Barre	0	------	--------	1	-------	0	0	-------	0	0	--------
Burlington	0	------	0	1	0	1	0	0	0	3	7
Rutland	0	------	0	0	1	0	0	0	0	0	8
Massachusetts:											
Boston	0	------	2	12	19	37	0	7	0	30	228
Fall River	.	------	0	14	3	1	0	1	0	9	37
Springfield	0	------	0	3	2	5	0	1	0	5	33
Worcester	1	------	0	2	19	18	0	1	0	0	58
Rhode Island:											
Pawtucket	0	------	0	1	0	0	0	0	0	0	13
Providence	0	-----	0	91	0	8	0	1	0	8	51
Connecticut:											
Bridgeport	0	- ----	0	0	3	1	0	1	0	0	35
Hartford	0	2	0	1	3	6	0	0	0	9	43
New Haven	0	------	2	0	2	2	0	0	0	1	41
New York:											
Buffalo	1	------	0	1	13	25	0	5	0	10	133
New York	28	43	10	61	95	456	0	76	0	84	1,620
Rochester	0	3	0	1	3	8	0	0	0	3	69
Syracuse	0	------	0	0	3	6	0	1	0	8	49
New Jersey:											
Camden	1	1	1	0	5	9	0	0	0	0	37
Newark	0	7	0	10	10	15	0	2	0	17	102
Trenton	0	-- --	0	0	5	7	0	1	0	0	41
Pennsylvania:											
Philadelphia	4	18	8	15	44	69	0	28	2	60	617
Pittsburgh	3	14	10	1	33	38	0	9	0	9	222
Reading	0	-- --	0	1	5	1	0	0	0	4	36
Scranton	1	----	--------	0	-------	3	0	-------	0	1	--------
Ohio:											
Cincinnati	2	2	6	1	8	14	0	4	0	10	146
Cleveland	1	98	0	5	8	40	0	9	1	19	195
Columbus	2	3	3	2	6	2	0	1	0	1	107
Toledo	0	1	1	1	3	18	0	4	0	6	81
Indiana:											
Anderson	0	------	1	0	2	0	0	0	0	3	11
Fort Wayne	0	------	2	0	2	4	0	0	0	1	31
Indianapolis	7	------	1	0	24	28	0	2	1	8	128
Muncie	0	------	0	0	1	3	0	0	1	1	14
South Bend	0	------	0	0	0	0	0	0	0	0	21
Terre Haute	0	------	0	0	4	0	0	0	0	0	37
Illinois:											
Alton	0	------	0	0	8	0	0	0	0	1	12
Chicago	8	38	4	10	62	302	0	41	0	29	802
Elgin	0	------	0	0	0	1	0	0	0	0	7
Moline	0	------	0	0	0	3	0	0	0	0	14
Springfield	0	2	1	0	6	12	0	0	0	2	35
Michigan:											
Detroit	4	2	0	29	14	84	0	15	0	89	294
Flint	0	------	--------	1	-------	13	0	-------	0	25	--------
Grand Rapids	0	------	2	1	0	23	0	0	0	2	44
Wisconsin:											
Kenosha	0	------	0	1	0	0	0	1	0	1	13
Milwaukee	0	------	0	5	5	35	0	6	0	5	100
Racine	0	------	0	1	0	0	0	0	0	0	16
Superior	0	------	0	43	1	7	0	0	0	0	9
Minnesota:											
Duluth	0	------	1	245	3	2	0	1	0	1	19
Minneapolis	1	------	1	1	11	30	0	1	1	1	128
St. Paul	0	------	0	1	8	10	0	2	0	10	63

City reports for week ended February 17, 1940—Continued.

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Iowa:											
Cedar Rapids	1	------	------	12	------	0	0	------	0	0	------
Davenport	0	------	------	1	------	2	0	------	0	0	------
Des Moines	0	------	0	1	0	13	2	0	0	0	51
Sioux City	0	------	------	0	------	1	0	------	0	0	------
Waterloo	0	------	------	1	------	6	0	------	0	0	------
Missouri:											
Kansas City	0	------	3	0	3	18	0	3	0	1	96
St. Joseph	0	------	0	0	5	4	0	0	0	0	36
St. Louis	2	19	8	0	30	21	0	9	0	3	268
North Dakota:											
Fargo	0	------	0	0	0	0	0	0	0	0	4
Grand Forks	0	------	------	0	------	0	0	------	0	0	------
Minot	0	------	0	0	0	2	0	0	0	0	5
South Dakota:											
Aberdeen	0	------	------	0	------	1	0	------	0	1	------
Sioux Falls	0	------	0	0	0	0	0	0	0	0	7
Nebraska:											
Lincoln	1	------	------	3	------	2	0	------	0	2	------
Omaha	0	------	0	4	5	2	0	1	0	2	64
Kansas:											
Lawrence	0	5	0	0	0	0	0	0	0	0	4
Topeka	0	------	0	0	6	2	0	0	0	0	29
Wichita	1	1	0	240	7	0	0	0	0	2	22
Delaware:											
Wilmington	0	------	0	0	3	10	0	1	0	4	40
Maryland:											
Baltimore	1	42	4	1	34	21	0	17	0	107	289
Cumberland	0	1	1	0	0	0	0	0	0	0	21
Frederick	1	------	0	0	0	0	0	0	0	0	5
Dist. of Col.:											
Washington	5	19	6	2	20	24	0	13	1	18	211
Virginia:											
Lynchburg	0	------	1	0	4	0	0	0	0	3	20
Norfolk	0	143	0	0	4	0	0	2	0	1	31
Richmond	0	1	2	0	7	0	0	1	0	0	53
Roanoke	1	------	0	3	7	1	0	0	0	3	17
West Virginia:											
Charleston	0	3	0	0	0	0	0	0	0	0	6
Huntington	0	------	------	0	------	1	0	------	0	0	------
Wheeling	0	------	0	0	4	1	0	1	0	2	33
North Carolina:											
Gastonia	0	------	------	1	------	1	0	------	0	0	------
Raleigh	0	------	0	0	3	1	0	0	0	0	18
Wilmington	1	------	0	0	0	0	0	0	0	0	11
Winston-Salem	0	1	0	0	5	3	0	2	0	0	27
South Carolina:											
Charleston	0	95	1	0	3	0	0	1	0	0	20
Florence	0	2	0	0	2	0	0	0	0	0	11
Greenville	1	------	0	0	4	0	0	0		0	28
Georgia:											
Atlanta	0	39	1	19	5	5	0	1	0	2	84
Brunswick	0	------	0	0	0	0	0	1	0	0	5
Savannah	0	25	3	0	2	1	0	4	0	0	46
Florida:											
Miami	0	8	1	0	7	1	0	2	0	1	55
Tampa	0	2	1	27	5	1	0	0	0	1	35
Kentucky:											
Ashland	0	------	0	0	0	1	0	0	0	0	3
Covington	0	------	0	0	1	0	0	1	0	0	14
Lexington	2	------	0	0	0	0	0	0	0	5	16
Louisville	0	67	2	2	12	16	0	4	0	0	102
Tennessee:											
Knoxville	0	28	2	0	3	16	0	0	0	0	31
Memphis	0	54	9	1	7	35	0	6	0	6	99
Nashville	0	------	5	17	18	6	0	1	0	2	78
Alabama:											
Birmingham	0	31	2	1	10	1	0	6	0	1	88
Mobile	1	84	3	0	0	1	0	0	0	0	30
Montgomery	1	4	------	5	------	2	0	------	0	0	------
Arkansas:											
Fort Smith	0	37	------	0	------	0	0	------	0	0	------
Little Rock	0	120	1	1	10	0	0	2	0	0	15
Louisiana:											
Lake Charles	0	------	0	0	2	0	0	0	0	0	3
New Orleans	2	77	9	3	27	4	0	13	2	3	242
Shreveport	0	------	2	5	19	4	0	2	1	0	56

City reports for week ended February 17, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oklahoma:											
Oklahoma City	1	------	0	0	9	1	0	1	0	0	55
Tulsa	0	------	------	1	------	1	0	------	0	8	------
Texas:											
Dallas	3	5	4	9	8	1	0	3	1	9	81
Fort Worth	0	------	0	0	8	0	0	0	0	20	59
Galveston	0	------	0	4	3	1	0	0	0	0	17
Houston	0	49	4	4	20	3	0	4	0	0	102
San Antonio	1	50	3	108	11	0	0	10	1	5	78
Montana:											
Billings	0	------	0	0	1	0	0	0	0	4	9
Great Falls	0	------	0	0	3	0	0	0	0	0	9
Helena	0	------	0	1	0	1	0	1	0	0	6
Missoula	0	1	0	1	0	0	0	0	0	0	1
Idaho:											
Boise	0	------	0	1	1	0	0	0	0	0	9
Colorado:											
Colorado Springs	0	------	0	0	2	1	0	0	0	0	17
Denver	9	------	0	2	7	9	0	3	0	3	76
Pueblo	0	------	0	6	2	4	0	1	0	0	14
New Mexico:											
Albuquerque	1	------	0	0	1	0	0	2	1	6	11
Utah:											
Salt Lake City	0	------	0	43	3	9	1	1	1	37	25
Washington:											
Seattle	0	------	3	113	2	5	0	3	0	5	102
Spokane	0	1	1	3	5	8	0	0	0	4	40
Tacoma	0	------	0	44	5	15	0	0	0	0	39
Oregon:											
Portland	0	9	0	134	11	2	0	0	0	3	98
Salem	0	------	------	23	------	0	0	------	0	0	------
California:											
Los Angeles	1	134	4	7	7	30	0	20	0	13	411
Sacramento	3	2	0	2	2	2	0	2	0	2	32
San Francisco	1	1	0	1	7	12	0	10	1	6	180

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
New York:			
New York	2	0	0
Pennsylvania:			
Philadelphia	1	0	1
Scranton	1	1	0
Minnesota:			
Minneapolis	1	0	0
Kansas:			
Wichita	1	0	0
Maryland:			
Baltimore	2	0	0
South Carolina:			
Charleston	1	0	0
Kentucky:			
Lexington	1	0	0
Alabama:			
Montgomery	0	0	1
Louisiana:			
New Orleans	0	0	1
Texas:			
Houston	0	0	1
San Antonio	1	0	0
California:			
Los Angeles	0	1	0

Encephalitis, epidemic or lethargic.—Cases: San Francisco, 1.
Pellagra.—Cases: Atlanta, 1; Birmingham, 2.
Typhus fever.—Cases: Lake Charles, 1; Fort Worth, 2.

FOREIGN REPORTS

CUBA

Habana—Communicable diseases—4 weeks ended February 10, 1940.—During the 4 weeks ended February 10, 1940, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	14		Tuberculosis	5	1
Scarlet fever	1		Typhoid fever	32	5

FINLAND

Communicable diseases—November 1939.—During the month of November 1939, cases of certain communicable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	346	Scarlet fever	511
Influenza	1,721	Typhoid fever	14
Paratyphoid fever	217	Undulant fever	1
Poliomyelitis	11		

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of February 23, 1940, pages 342–345. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Yellow Fever

Brazil.—For the period January 7–27, 1940, deaths from yellow fever (jungle type) have been reported in Brazil as follows: Espirito Santo State—Alfredo Chaves, 1; Cachoeiro Itapemirim, 2; Domingos Martins, 2; Itapemirim, 2; Joao Neiva, 3; Joao Pessoa, 1; Lauro Muller, 1; Santa Leopoldina, 4; Sao Felipe, 4; Serra, 2; Viana, 1; Rio de Janeiro State—Santo Eduardo, 1.

Colombia—Caldas Department—La Pradera.—On January 30, 1940, 1 death from yellow fever was reported in La Pradera, Caldas Department, Colombia.

X

Public Health Reports

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IN THIS ISSUE

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FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

January 28–February 24, 1940

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the PUBLIC HEALTH REPORTS under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended February 24, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935–39.

DISEASES ABOVE MEDIAN PREVALENCE

Influenza.— There was a sharp increase in influenza from approximately 48,000 cases during the 4 weeks ended January 27 to 64,676 cases during the 4 weeks ended February 24. The South Atlantic and West South Central regions continued to report the highest incidence, with rather sharp rises in the number of cases in the East South Central and Pacific regions. The South Atlantic region reported about 3,000 fewer cases than occurred during the preceding 4 weeks, but in the West South Central region the number of cases was almost twice the number reported during the preceding 4-week period. In the Mountain region the incidence dropped from approximately 8,000 cases during the month of December to approximately 1,500 cases during the current period, and the West North Central region reported a decline from the preceding 4-week period, which apparently was the peak incidence for that region.

Compared with preceding years, the current incidence (64,676 cases) was more than 2.7 times that recorded for the corresponding period in 1939 and about two and one-half times the 1935–39 median expectancy for this period. With the exception of the year 1937, when more than 100,000 cases were reported for this period, the current incidence is the highest in the 12 years for which these data are available. In 1939 the peak of the influenza rise was not reached until March, while in preceding years it reached its highest level during

the months of January or February. As there has been a decline in the number of cases since the week ended February 3, it is possible that the incidence in that week (approximately 18,000 cases) will be the highest level attained during this season.

Poliomyelitis.—There were 109 cases of poliomyelitis reported during the current 4-week period, as compared with 66, 89, and 80 cases for the corresponding period in 1939, 1938, and 1937, respectively. While the disease is showing the usual seasonal decline, every region except the South Atlantic and East South Central reported a relatively high incidence. In general, the number of cases is the highest since 1932, when 130 cases were reported for the period corresponding to the current one.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period Jan. 28–Feb. 24, 1940, the number for the corresponding period in 1939, and the median number of cases reported for the corresponding period in 1935–39 [1]

Division	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median
	Diphtheria			Influenza [2]			Measles [3]			Meningococcus meningitis		
United States [1]	1,565	1,994	2,369	64,676	23,994	25,391	21,999	53,546	53,546	178	227	525
New England	23	39	43	57	122	122	3,191	6,201	5,686	2	12	12
Middle Atlantic	265	331	394	285	840	287	1,688	5,590	8,659	51	50	60
East North Central	304	411	500	2,412	5,016	2,532	2,067	5,799	5,799	10	19	98
West North Central	104	168	196	833	793	1,285	3,724	8,274	6,372	19	13	51
South Atlantic	266	353	403	22,527	9,184	8,761	1,519	9,968	9,232	36	41	93
East South Central	125	139	178	5,571	2,196	3,630	812	1,494	1,494	22	51	92
West South Central	286	299	366	26,225	4,322	5,058	1,334	2,117	1,667	16	20	43
Mountain	77	86	71	1,528	1,170	1,170	1,860	3,251	2,628	12	11	23
Pacific	115	138	146	5,238	351	2,390	5,804	10,852	2,764	10	10	18
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States [1]	109	66	80	19,277	22,169	26,877	257	1,554	1,144	292	433	433
New England	3	0	1	1,050	1,539	1,585	0	0	0	24	12	12
Middle Atlantic	12	7	7	6,038	5,100	5,836	0	0	0	46	50	54
East North Central	20	9	9	6,368	8,659	8,767	47	749	196	44	52	52
West North Central	10	4	5	1,796	2,507	3,765	102	254	413	20	18	28
South Atlantic	14	17	17	1,127	1,087	1,034	3	7	5	46	74	84
East South Central	12	14	14	735	623	614	13	42	9	20	47	47
West South Central	13	6	6	439	761	654	14	273	228	50	144	141
Mountain	6	4	3	734	586	897	67	134	120	14	13	17
Pacific	19	5	16	990	1,304	1,352	11	95	148	28	23	26

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 44 States and New York City.
[3] 47 States. Mississippi is not included.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—The incidence of diphtheria continued at a low level, the reported cases numbering 1,565, which is about 75 percent of the number recorded for the corresponding period in 1939, and about 65 percent of the 1935–39 average incidence for this period. All

regions participated in the low record except the Mountain region; there the number of cases was about 10 percent above the median expectancy.

Measles.—The number of cases of measles reported was approximately 22,000, an increase of about 6,000 cases over the preceding 4-week period. All regions contributed to the increase except the East North Central. In that region a decrease of about 300 cases was reported. An increase of this disease is normally expected at this season of the year. For the country as a whole the current incidence is about 40 percent of the 1935–39 median incidence for the corresponding period, and, with the exception of the year 1937 when the cases numbered approximately 21,000, the incidence is the lowest for this period in the 12 years for which these data are available.

Meningococcus meningitis.—For the 4 weeks ended February 24, there were 178 cases of meningococcus meningitis reported, as compared with 227, 378, and 678 cases for the corresponding period in 1939, 1938, and 1937, respectively. Each region of the country shared in the favorable situation of this disease that now exists, the incidence in each section being considerably below the 1935–39 median incidence for this period.

Scarlet fever.—The scarlet fever incidence was also comparatively low—19,277 cases as compared with 22,169 in 1939, and with an average of approximately 27,000 cases for the corresponding period in 1935–39. The Middle Atlantic, South Atlantic, and East South Central regions reported a few more cases than might normally be expected, but in all other regions the incidence was relatively low. This disease has also reached a new low level, the current incidence being the lowest in the 12 years for which these data are available.

Smallpox.—The number of cases of smallpox (257) was the lowest on record for this period. About 65 percent of the total was reported from 5 States, Colorado (59), Minnesota (33), Iowa (29), Missouri (25), and Wisconsin (23). The most significant decreases were reported from the North Central and Pacific regions where the current incidence was the lowest on record for this period. While the figures from other regions were not the lowest on record, they represented very appreciable decreases from those of the past 2 or 3 years when smallpox was unusually prevalent in the Mountain, Pacific, and North Central regions.

Typhoid fever.—The typhoid fever incidence was also below normal—292 cases as compared with 433, 523, and 390 for the corresponding period in 1939, 1938, and 1937, respectively. The number of cases in the New England region was twice the median expectancy, and the Mountain and Pacific regions reported about the average number of cases, but in all other regions the incidence was relatively low.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended February 24, based on data received from the Bureau of the Census, was 13.2 per 1,000 population (annual basis). The current rate was the same as that for the corresponding period in 1939, and the 1935–39 average rate was also 13.2. The highest weekly death rate (13.6) in large cities occurred during the week ended February 3, and the largest number of cases of influenza reported to date occurred during the same week. By the last week of the current period the weekly death rate had dropped to 12.6 and the influenza incidence had dropped about 25 percent. It thus becomes apparent that the presence of influenza greatly affects the death rate at this season of the year. For the years of about normal influenza incidence the average death rate for this period is about 12 per 1,000 inhabitants.

THE NATIONAL HEALTH SURVEY*

SOME GENERAL FINDINGS AS TO DISEASE, ACCIDENTS, AND IMPAIRMENTS IN URBAN AREAS

By Rollo H. Britten, *Senior Statistician*, Selwyn D. Collins, *Principal Statistician*, and James S. Fitzgerald, *Research Analyst, United States Public Health Service*

CONTENTS

In a preceding article [1] have been discussed the scope, method, and general definitions of the National Health Survey, a house-to-house canvass of 703,092 urban families in 18 States and 36,801 families in certain rural areas, made to determine the frequency of serious disabling illness, medical care received therefor, and their relation to social and economic conditions. The survey was patterned on previous ones conducted by the United States Public Health Service and in general followed the established techniques developed in such surveys, information being obtained by trained enumerators from the

*From the Division of Public Health Methods, National Institute of Health. The project was executed with the aid of grants from the Works Progress Administration. Acknowledgment is made to various members of the National Health Survey staff for assistance in the preparation of this article.

[1] The National Health Survey: Scope and method of a Nation-wide canvass of sickness in relation to its social and economic setting. By George St. J. Perrott, Clark Tibbitts, and Rollo H. Britten. Pub. Health Rep., 54: 1663 (1939).

housewife or other responsible member of the household. In this instance, periodic visits were impracticable, necessitating some modification of the type of illness data requested. On the other hand, more detailed information on chronic diseases and impairments was collected than in previous surveys. The present report summarizes data collected in the urban survey on disease, accidents, and impairments. The population covered is 2,502,391 white and colored persons, or 3.6 percent of the urban population of the United States (1930).[2]

GENERAL RATES

Several measures of illness were employed, the rates for which are summarized in table 1. Because of the recognized impossibility of complete enumeration of illness, some of these rates are somewhat below the true values.

TABLE 1.—*Rates of illness according to several measures* [1]

Item	Type of information	Rate
1	Percentage of persons disabled on day of visit [a]	4.4
2	Percentage of persons disabled for the whole 12 months immediately preceding visit [a]	1.2
3	Percentage of persons reported as having a chronic [b] disease or impairment [c d]	17.7
	Illnesses disabling for a week or longer during the 12 months immediately preceding the visit: [e f]	
	Frequency per 1,000 persons:	
4	All illnesses	171
5	Acute	123
6	Chronic [b]	48
7	Diseases	45
8	Impairments [c]	2.9
9	Excluding persons disabled for the whole period	150
	Number of days of disability per person observed: [g]	
10	All illnesses	9.9
11	Acute	2.6
12	Chronic	7.3
13	Diseases	6.3
14	Impairments	1.0
15	Excluding persons disabled for the whole period	5.6
	Number of days of disability per case: [g]	
16	All illnesses	58
17	Acute	21
18	Chronic	154
19	Excluding persons disabled for the whole period	36
20	Percentage of workers [h] (15–64 years of age) who were reported to be "unemployable" by reason of disability [e]	1.1

[1] Table and chart references will be found in the appendix.

Proportion of persons disabled on an average winter day.—As shown in table 1 (item 1), 4.4 percent of the enumerated population were reported as disabled on the day of the visit. Disability was defined to mean inability to work, attend school, care for home, or carry on

[2] The sample was chosen to be representative in general of cities in the United States according to region and size. In large cities (100,000 and over) the population to be canvassed was determined by a random selection of many small districts based on those used in the United States Census of 1930. In the smaller cities selected for study the population was enumerated completely. See the article cited above for a more detailed account of the sampling procedure and a comparison of certain characteristics of the population enumerated with those of the urban population as a whole (Census, 1930).

National Health Survey data published in Health as an Element in Social Security, by George St. J. Perrott and Dorothy F. Holland, in The Annals of the Academy of Political and Social Science, March 1939, are for white persons only; therefore some of the rates differ somewhat from corresponding rates in the present article.

other usual pursuits by reason of disease, accident, or physical or mental impairment.[3] Since the survey was conducted from November 1935 to March 1936,[4] a higher rate of prevalence would be expected than if the canvassing had been spread over the entire year. The occurrence of a mild epidemic of influenza in the spring of 1936 [5] no doubt resulted in a larger percentage of persons being disabled on any one day than would be the case in a nonepidemic year. The rate is also higher than figures obtained in previous surveys [6] because of the inclusive nature of the definition of illness. (For instance, of the 4.4 percent about a fourth (see item 2) were recorded as having been disabled for the entire 12 months immediately preceding the visit.)

Proportion of persons reported as having a chronic disease or impairment.—The 4.4 percent disabled on a single day falls far short of the proportion actually suffering from disease, since nondisabling conditions were not included therein. No inquiry was made in this survey as to acute affections which did not cause disability; but, because of the importance of potentially disabling chronic diseases, certain information in regard to them was requested. In addition a record was made of orthopedic impairments (loss of members or presence of impaired or crippled members and of deformities), blindness, and deafness. As shown in table 1 (item 3), 17.7 percent of all persons enumerated were reported as having one or more chronic diseases [7] or impairments. Although the above rate is influenced by the lack of an objective standard of severity (as a basis for inclusion or exclusion), the measure is useful in indicating the magnitude of the

[3] Persons in institutions for the care of physical or mental diseases were not directly enumerated in the survey, but the family was asked to report any such persons who had formerly lived in the household. The record obtained was incomplete. For instance, the frequency of cases in institutions for the care of disease for the whole 12 months immediately preceding the visit was 0.8 per 1,000 persons in the entire population, giving 0.29 days per person. On the basis of data given in the census of hospitals of the American Medical Association for the year 1935, hospital days for patients in tuberculosis and mental hospitals in the country as a whole amounted to 1.63 per person in the entire population (Hospital Service in the United States, J. Am. Med. Assoc., 106 783 (1936) (see p. 790)).

[4] The record of the disabling illness present on the day of the visit therefore refers to a varying day, but each family enters into the picture only once.

[5] See Influenza Mortality in the United States, 1936. By Mary Gover. Pub. Health Rep., 51: 1399 (1936).

[6] Only 1.9 percent of 637,038 persons surveyed by the Metropolitan Life Insurance Co. were disabled on an average spring day, 1915–17; in the 10 localities covered the figure ranged from 1.4 to 3.1 percent.

The Health and Depression Studies made by the U. S. Public Health Service of about 24,000 persons in 6 large cities (200,000 to 2,000,000 population, 1930) in the early spring of 1933 showed a prevalence rate of disabling illness of 2.3 percent. (Corresponding data have not been tabulated for the other cities included in the studies.)

In 6 canvasses of about 5,000 to 12,000 inhabitants of 17 mill villages of South Carolina at different seasons in 1917, the prevalence rate varied from 1.5 to 3.2 percent. Among 4,161 inhabitants of 7 mill villages of South Carolina in May–June of 1916, the prevalence rate was 4.5 percent, but the observations were made during the height of the pellagra season.

None of these studies made any special inquiries about blindness, crippling defects, mental and nervous patients in institutions, or mental defectives not in institutions, all of which classes the Health Survey attempted to record.

[7] Diseases the symptoms of which were stated to have been present for 3 months or longer, whether or not disabling, have been classified as chronic.

problem of chronic disease and impairment in special population groups (i. e., when the population is classified, for instance, by age or family income).

Annual frequency of illnesses disabling for a week or longer.—The frequency of illnesses causing disability (as defined above) of at least 7 consecutive days in a 12-month period was 171 per 1,000 persons.[8] Because of the fact that the illness record for a 12-month period was necessarily obtained at a single visit, the above minimum (7 consecutive days of disability) was chosen to avoid too great losses due to the difficulty of recalling minor cases of illness. It is important to note that such a limitation not only reduces the frequency rate greatly, but increases the proportion of cases due to chronic disease or specific diagnoses, the proportion in different age groups, and many other relationships. Although the limitation makes difficult comparison with the results of other surveys, it has the advantage of concentrating attention on illnesses most likely to be a serious economic burden.

Cases disabling for a week or longer have been classified as acute or chronic (see footnote 7). The annual frequency of acute illness was 123 per 1,000 persons, that of illness due to chronic affections was 48 per 1,000 persons.

Disability.—The annual number of days of disability (from illnesses disabling for a week or more) was 10 days per person under observation; days of disability per case were 58 (items 10 and 16 of table 1). Inclusion of illnesses disabling for less than a week, had this been possible, would have increased the days per person somewhat[9] and, of course, greatly decreased the average duration of disability per case. Days per case, it should be observed, are not necessarily based on the total duration of disability of the case, but only on that part accruing within the 12-month period whether or not the case terminated within such period.

For acute illnesses the days per person per year were 2.6 and the days per case 21 (items 11 and 17 of table 1); for illnesses due to chronic affections these rates were, respectively, 7.3 and 154 (items 12 and 18). The importance of chronic diseases and impairments in

[8] See article cited in footnote 1 for definitions.

Certain points require emphasis.

(*a*) One person may have had more than one recorded illness during the year.

(*b*) An illness due to more than one diagnosis was counted only once in the computation of this rate.

(*c*) Cases with onset of disability prior to the 12-month period were included, the frequency of such cases being 18 per 1,000 persons.

(*d*) Records of all confinements, hospital cases, and deaths were taken without limitation as to the duration of disability. The rate for cases in these categories which had disabled for less than 7 days was 4 per 1,000 persons.

[9] Unpublished data from the survey made by the Committee on the Costs of Medical Care show 0.73 days of disability per person per year for cases disabling for less than 7 consecutive days (exclusive of hospital cases).

the disability picture is manifest, since 74 percent of the days of disability were due to such conditions.

In the discussion of the percentage disabled on the day of the visit, mention was made of persons disabled for the entire 12 months immediately preceding the visit. Although this group is responsible for only a small proportion of the illnesses disabling for a week or more, it is responsible for a large part of the disability. In table 1, rates are given with this group excluded (items 9, 15, and 19).

"*Unemployables.*"—An item on the schedule regarding the employment status of individuals furnished a further measure of illness. The question was whether the person, if not employed and not seeking work, was prevented from so doing by physical or mental disability.[10] The group was made up largely of individuals with severe chronic disease or incapacitating impairments; hence the term "unemployable" may be applied, with some reservations, to the group. All discussions relative to this group will be limited to the ages 15–64, because of uncertainty as to the classification of persons of other ages. Special mention should be made of the fact that all persons in institutions for the care of disease for the entire 12 months immediately preceding the visit have been excluded from the group under consideration.

The percentage of the total enumerated population (ages 15–64) falling in the "unemployable" group was 0.45; however, since these persons, by definition, would have been in the labor market if they had not been incapacitated by disease or impairment, a more useful index can be obtained by limiting the base to persons who were working or seeking work (plus the unemployables themselves). The percentage, given as item 20 in table 1, is 1.1 for the age group 15–64.

CAUSES OF DISABLING ILLNESS

The annual frequency of illnesses disabling for a week or longer and the days of disability per person observed are shown in table 2 for particular diagnoses or groups of diagnoses. Classification is by the sole or primary diagnosis.[11] The most common causes of the serious illnesses recorded in this study were respiratory in nature (colds, influenza, tonsillitis, pneumonia, tuberculosis). Second in rank were the common communicable diseases of childhood.

[10] Enumerators were instructed not to include as unemployable, "persons who have an acute illness at present * * * and will return to work or will seek work on recovery."

[11] The primary diagnosis is that which had been associated with the disability for the longest period; or, if a separate period of disability was not specified for any diagnosis, the primary diagnosis is the one which was regarded by the family as the most important cause of the disability.

Cases are classified by diagnosis in this report in accordance with the statements given by the family. (See article cited in footnote 1 for discussion of use made of confirmations of diagnoses received from physicians.)

Syphilis and gonorrhea, although of recognized importance as causes of disability, are not given separately in the table because of the incompleteness of reports of such diseases in a house-to-house canvass.

TABLE 2.—*Annual frequency and disability rates of illnesses disabling for 1 week or longer,[e] by diagnosis [f]*

Diagnosis	Frequency (per 1,000 persons)	Days of disability per person observed [e]
All diagnoses [f]	171	9.9
Communicable diseases:		
Common communicable diseases of childhood	26.3	.55
Other	2.8	.13
Cancer and other tumors	2.9	.29
Diabetes mellitus	.89	.15
Rheumatism and allied diseases	5.9	.71
Cardiovascular-renal diseases	11.0	1.34
Nervous and mental diseases	5.4	1.02
Diseases of ear and mastoid process	2.0	.068
Diseases of respiratory system:		
Tuberculosis (including nonrespiratory)	1.3	.32
Pneumonia (all forms)	4.7	.18
Tonsillitis (including tonsillectomies)	9.9	.14
Other diseases of respiratory system (colds, influenza, etc.)	35.0	.84
Diseases of digestive system:		
Appendicitis (including appendectomies)	5.0	.20
Hernia	1.0	.094
Diseases of teeth, mouth, and gums	.52	.017
Other diseases of the digestive system	7.7	.54
Diseases of thyroid gland	.62	.061
Anemia	.47	.067
Hemorrhoids	.72	.033
Varicose veins	.38	.040
Diseases of bladder, urethra, urinary passages, and male genital organs	1.3	.10
Diseases of female genital organs and complications of pregnancy	3.2	.22
Confinements	[1] 15.0	.38
Diseases of skin and cellular tissue	2.0	.11
Accidents	15.4	.75
Orthopedic impairments	2.5	.86
Blindness and deafness	.40	.14
Other and ill-defined diagnoses	6.6	.58

[1] Live birth rate is 14.0 per 1,000 persons.

Since previous studies have largely been concerned with frequency rates, in this report it is desirable to place special emphasis on diagnoses in relation to the volume of disability (i. e., days of disability per person observed) associated with them. Hence, the disability rates are shown graphically in figure 1.

The cardiovascular-renal group of diseases is responsible for 1.34 days of disability per year per person observed. Second is the group of nervous and mental diseases, with 1.02 days. This figure would undoubtedly be raised considerably if persons confined in institutions for the care of mental disease could have been completely reported (see footnote 3). Orthopedic impairments caused a loss of 0.86 days per person, and accidents 0.75 days. Respiratory conditions, taken as a group, were responsible for 1.48 days per person per year (tuberculosis, 0.32; pneumonia, 0.18; tonsillitis, 0.14; others, including colds and influenza, 0.84). Rheumatism and allied diseases caused 0.71 days per person per year.

ILLNESS IN PARTICULAR AGE GROUPS

Judged by the frequency of illnesses disabling for a week or longer, childhood and old age are especially prone to sickness. The severity

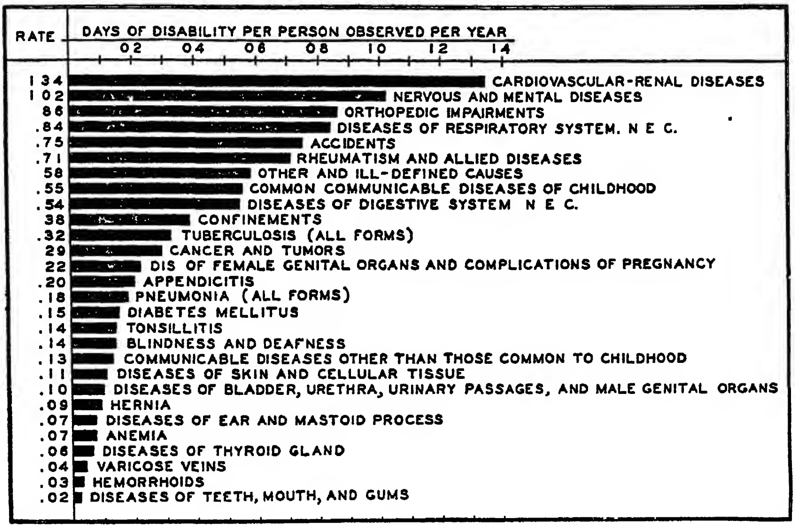

FIGURE 1.—Disability rate by diagnosis [d] for illnesses disabling for one week or longer.[e f]

(days of disability per case), however, is least in childhood and increases steadily throughout life. The number of days of disability per person observed—a rate which expresses the combined effect of frequency and severity—is about the same in childhood and youth, and then increases rapidly. These facts are brought out in table 3, which gives the annual frequency and the days of disability per case and per person for illnesses disabling for a week or longer during the 12 months immediately preceding the visit.

TABLE 3.—*Annual frequency and disability rates of illnesses disabling for 1 week or longer,[e] according to age [f]*

Age in years	Frequency (per 1,000 persons)	Days of disability: Per case	Days of disability: Per person observed
All ages	171	58	9.9
Under 15	214	27	5.7
15-24	131	42	5.4
25-64	153	69	10.5
65 and over	279	131	36.1

The change in severity of illness with increasing age indicates a shift from acute to chronic disease. Table 4 distinguishes the cases on this basis and also separates those which caused disability for the full year under study.

Mention should be made of a number of important points which are brought out in this table:

TABLE 4.—*Annual frequency of acute and chronic illnesses disabling for a week or longer,[e] according to age [f]*

Age in years	All illnesses	Acute	Chronic [g]		
			Total	Disabled for 12 months immediately preceding visit	Other
ANNUAL FREQUENCY PER 1,000 PERSONS					
All ages	171	123	48	12	36
Under 15	214	198	16	3	13
15-24	131	109	22	5	18
25-64	153	96	57	13	44
65 and over	279	102	177	63	114
DAYS OF DISABILITY PER CASE [g]					
All ages	58	21	154	(12 months by definition)	86
Under 15	27	19	130		82
15-24	42	21	141		82
25-64	60	23	147		84
65 and over	131	27	191		96
DAYS OF DISABILITY PER PERSON OBSERVED PER YEAR [g]					
All ages	9.9	2.6	7.3	4.3	3.1
Under 15	5.7	3.7	2.0	1.0	1.1
15-24	5.4	2.3	3.1	1.7	1.5
25-64	10.5	2.2	8.4	4.7	3.7
65 and over	36.1	2.7	33.4	22.6	10.8

1. Even when limited to cases disabling for a week or longer, the diseases of childhood are overwhelmingly of an acute nature, the ratio of acute to chronic being 12 to 1.

2. On the other hand, among persons aged 65 years and over, a majority of the serious illnesses were chronic, and about a third of these were in the group of cases disabling for the full year. Among these persons over 65 years of age, the ratio of acute to chronic illness was 0.6 to 1.

3. The duration of disability per case increased rapidly with age (from 27 days among children to 131 in the group 65 years of age and older).

4. The duration of disability per case for acute or chronic diseases, taken separately, also increased with age, but not in such a marked degree.

5. The ratio between the duration of disability per case for acute and for chronic diseases was practically constant from age to age.

6. Of the 36 days of disability per person per year among those 65 years of age and over, 23 days were contributed by the group disabled for the entire 12 months.

The above indications are based on rates of illnesses in specific age groups; in terms of the actual number of cases in such age groups, chronic disease and invalidism offer especially difficult problems in the productive ages. (See further discussion on p. 458.)

7. In summary, the increase in the amount of disability with advancing age reflects primarily an increasing proportion of chronic cases and, among the chronic cases, an increasing proportion of persons disabled throughout the year of the study.

INCOME, EMPLOYMENT STATUS, AND ILLNESS

Illness is greatest in the population group least able to bear the economic burden involved. Although this fact is well known, the National Health Survey data are of value as corroborative evidence and also contribute information on certain novel aspects. No attempt will be made to assess the proportion of the total excess which is due to factors connected with low income, or the proportion in which low income has resulted from chronic sickness. The point to be made is that, regardless of cause, the groups in poor economic circumstances have excessive illness rates.[12]

Distribution of persons surveyed by family income and relief status.[13]—Persons in families with annual incomes under $1,000 comprised about 40 percent of the surveyed group; about 65 percent were in families with annual incomes under $1,500, and 80 percent in families with incomes under $2,000. Almost one half of the lowest income group had received relief during the year 1935.

Frequency of serious illness at different income levels.—In table 5 is given the frequency of illnesses disabling for a week or more according to the income and relief status of the family. The excess in the relief group over the rate in the group with incomes of $5,000 or more is 59 percent for all causes, 49 percent for acute diseases and 85 percent for chronic diseases (see footnote 7). There is also a definite excess for the nonrelief group with incomes below $1,000, and some excess in the next higher group. However, above the $1,500 level there is no excess.[14]

Amount of disability at different income levels.—The excess in the low income groups is greater in terms of days of disability per person per year than in terms of frequency, because of a longer average duration of cases in the low income groups. The relief group shows an excess

[12] In the Health Survey, families were classified by income received during the 12 months preceding the interview and also according to whether or not relief had been received during that time. Information on employment status of the individual was obtained as of the day of the canvass. Again reference is made to definitions given in the paper cited in footnote 1.

[13] For the purpose of this comparison, all persons living in a household are classified according to the total income of related members of that household. See appendix table C in paper cited in footnote 1 for detailed distributions of persons by annual family income, color, and sex.

[14] There is some difference in the age composition of the various groups, which explains the slight rise in the rate for chronic diseases at the higher income levels.

of 132 percent over the $5,000 class, and the nonrelief group under $1,000 an excess of 68 percent. Above $1,500 there is no excess. The rates are presented in figure 2, which gives a vivid portrayal of the problem of illness in the low income groups.[15]

TABLE 5.—*Annual frequency of acute and chronic illnesses disabling for 1 week or longer*[a] *(per 1,000 persons) as related to economic status*[f]

Annual family income and relief status	All illnesses	Acute	Chronic[b]
All incomes	171	123	48
Relief	232	160	72
Nonrelief			
Under $1,000	176	120	56
$1,000 to $1,500	155	117	38
$1,500 to $2,000	146	111	35
$2,000 to $3,000	146	110	36
$3,000 to $5,000	145	109	36
$5,000 and over	146	107	39
Relief and nonrelief under $1,000	*200*	*138*	*63*

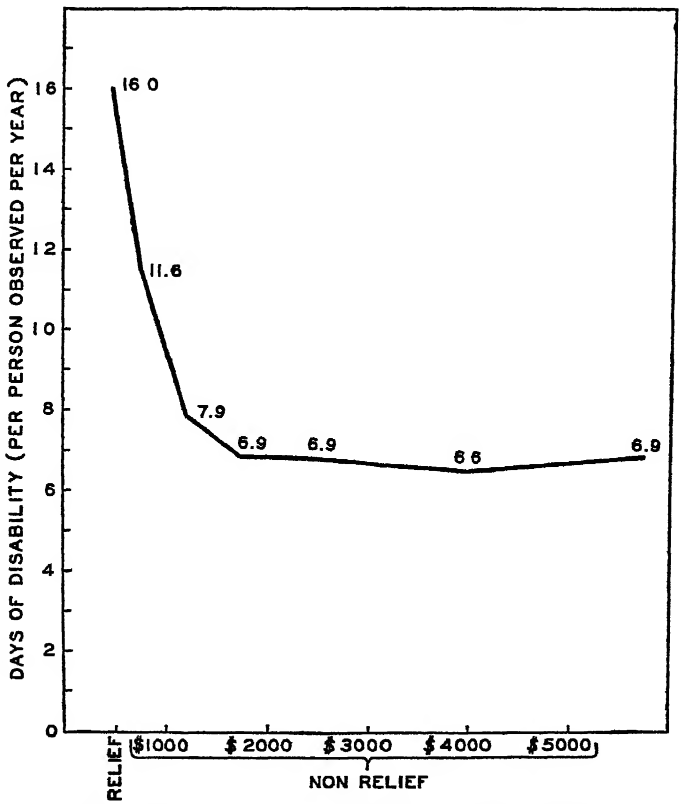

FIGURE 2.—Disability rate according to annual family income and relief status.[a,f]

[15] The income for the relief group is placed at $500 in the chart, which figure was taken as a rough estimate of the average annual income of urban relief families.

Differences by age.—The greatest relative excess of illness in the lower income groups over the higher is found in the productive ages, as shown in figure 3 and table 6. The excess in the relief group over the $5,000 class is as follows for the different ages:

Age	*Percentage excess*
Under 15	8
15–24	177
25–64	263
65 and over	139

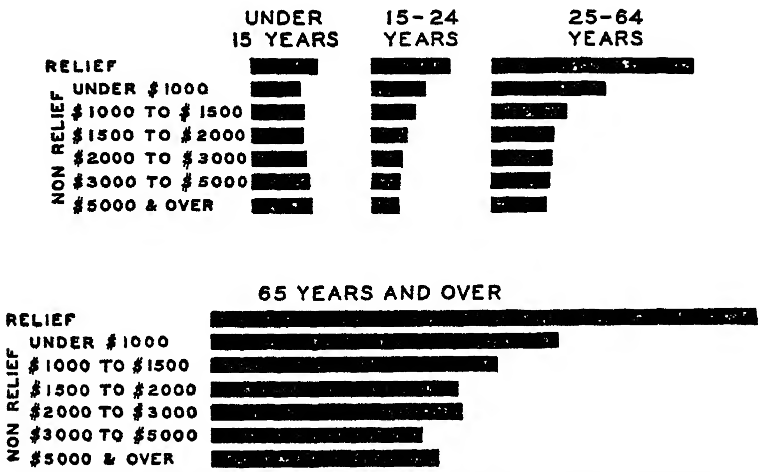

FIGURE 3.—Disability rate according to age and annual family income and relief status.

TABLE 6.—*Days of disability (per person observed per year)[e] for persons of different ages, according to economic status [f]*

Annual family income and relief status	All ages	Under 15	15-24	25-64	65 and over
All incomes	9.9	5.7	5.4	10.5	36.1
Relief	16.0	6.8	8.6	21.8	58.8
Nonrelief:					
Under $1,000	11.6	5.0	5.9	12.4	37.6
$1,000 to $1,500	7.9	5.4	4.7	8.0	30.7
$1,500 to $2,000	6.9	5.3	4.2	6.8	26.7
$2,000 to $3,000	6.9	5.7	3.6	6.6	27.0
$3,000 to $5,000	6.6	5.8	3.4	6.4	22.8
$5,000 and over	6.9	6.3	3.1	6.0	24.6
Relief and nonrelief under $1,000	*13.5*	*6.0*	*7.1*	*16.0*	*44.4*

Diagnoses chiefly responsible for excess amount of disability in low-income groups.—Further light is thrown on the problem of excessive illness rates in the lower income groups by consideration of the degree of excess for specific diagnoses. A later report will deal with this aspect in greater detail; hence, for simplicity, the data given at this time (table 7) will be limited to the ratios of the annual per capita volume of disability for different income groups to that in the group

with annual incomes of $3,000 or more.[16] The highest ratios are found for hernia, tuberculosis, varicose veins, blindness and deafness, diabetes, diseases of female genital organs, hemorrhoids, orthopedic impairments, miscellaneous digestive diseases, and rheumatism. In general, diagnoses of an acute nature show much less association than chronic diagnoses.

TABLE 7.—*Ratio [1] of annual per capita volume of disability [e] for different income groups to that in the highest income group, according to diagnosis [f] [k]*

Diagnosis [j]	Annual family income and relief status					
	Relief	Nonrelief				
		Under $1,000	$1,000 to $1,500	$1,500 to $2,000	$2,000 to $3,000	$3,000 and over
Hernia	1, 261	435	304	191	200	100
Tuberculosis (including nonrespiratory)	886	392	253	177	139	100
Varicose veins	714	329	171	193	136	100
Blindness and deafness	502	312	171	140	150	100
Diabetes mellitus	423	231	154	141	128	100
Diseases of female genital organs and complications of pregnancy	420	230	160	150	150	100
Hemorrhoids	371	182	153	129	135	100
Orthopedic impairments	367	251	153	123	112	100
Diseases of digestive system other than appendicitis, hernia, and diseases of teeth, mouth, and gums	361	191	121	97	100	100
Rheumatism and allied diseases	351	202	132	105	110	100
Anemia	310	198	133	110	124	100
Diseases of bladder, urethra, urinary passages, and male genital organs	304	174	110	101	88	100
Nervous and mental diseases	298	212	140	120	112	100
Confinements	289	200	205	168	142	100
Diseases of skin and cellular tissue	279	176	137	101	97	100
Diseases not elsewhere classified	276	168	118	105	103	100
Cardiovascular-renal diseases	272	158	112	101	101	100
All diagnoses	266	167	121	107	106	100
Cancer and other tumors	248	148	114	114	100	100
Accidents	213	167	124	109	107	100
Pneumonia (all forms)	193	120	100	93	107	100
Diseases of respiratory system other than tuberculosis, pneumonia, and tonsillitis	192	125	92	90	95	100
Communicable diseases other than those common to childhood	183	125	83	73	78	100
Diseases of teeth, mouth, and gums	147	147	100	100	87	100
Tonsillitis (including tonsillectomies)	138	108	100	100	108	100
Diseases of ear and mastoid process	132	101	93	87	101	100
Diseases of thyroid gland	122	94	61	68	69	100
Common communicable diseases of childhood	110	86	93	95	100	100
Appendicitis (including appendectomies)	104	83	87	83	87	100

[1] Based on rates adjusted to the age composition of the total population specified in reference [f].

Proportion of employed and unemployed workers disabled on the day of the visit.—Intertwined with the problem of illness in the low-income groups is that of illness among the unemployed. Since employment status was recorded in the survey as of the day of the visit, the most appropriate illness measure is the percentage of persons unable to work on that day. The comparison in figure 4 excludes persons who had been removed from the labor market by reason of chronic disease or impairment—the "unemployables" previously mentioned. Had they been included the contrast between the illness rates for the em-

[16] Persons in institutions for the care of disease for the entire 12 months immediately preceding the visit are excluded from these comparisons.

ployed and the unemployed would have been far greater. Also many of the disabled persons in the unemployed group presented in figure 4 are potential "unemployables." However, the data bring out the great excess of illness among unemployed persons who have not yet abandoned the hope of working. As stated previously, the rates for all groups are higher than they would have been had the visits not been confined largely to winter months.

A more intensive study, to be published later in this series, will show that the illness rate among the unemployed is related to the relief status of the families and of the worker. The rate is higher in relief than in nonrelief families, and among relief families it is higher for workers who were not on work relief than for those who were.

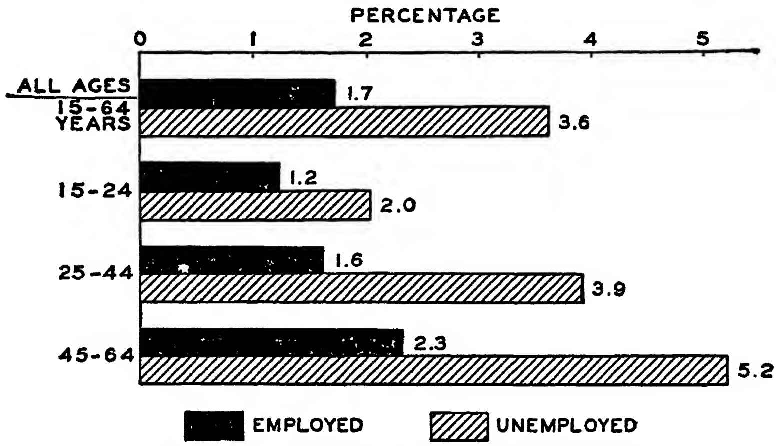

FIGURE 4.—Percentage of employed and unemployed workers [1] disabled on the day of the canvass, in different age groups.[a]

Proportion of "unemployables" in different income groups.—A still further aspect of the problem of illness and income is the concentration of persons reported to be "unemployable" by reason of disability in the low-income groups and especially in the relief group. As in table 1 (item 20) the base for these calculations is the number of workers plus the unemployables themselves. Figure 5 shows the relationship, the comparison being limited to the ages 15–64. In proportion to the number of persons, there were 13 times as many unemployables in the relief group as in the group with incomes of $5,000 and over (table 8). The relative excess is greatest in the age group 35–44.

CHRONIC DISEASE

With the reduction in mortality from acute diseases and the aging of the population, chronic diseases are assuming a more and more important place in the field of public health. This fact was recognized

in planning the Health Survey, and special effort was made to obtain information on disability from chronic diseases and some estimate of

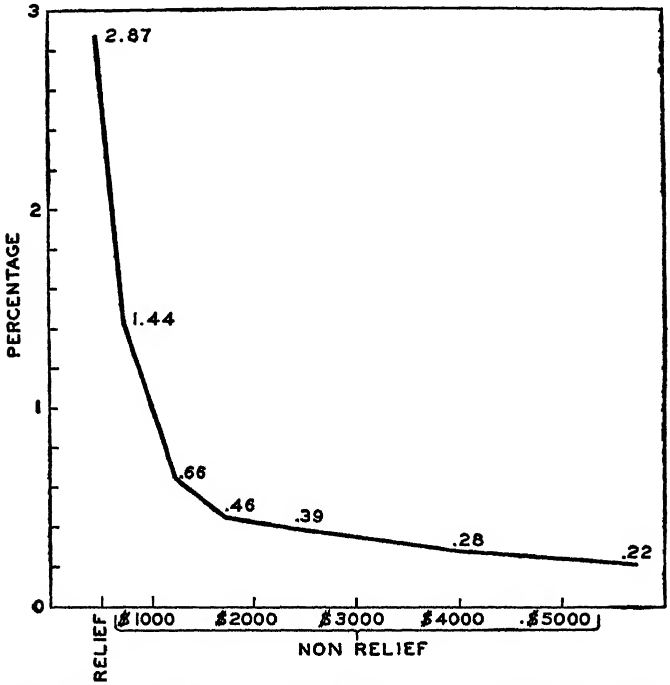

FIGURE 5.—Percentage of workers [a] prevented from being employed or seeking work by reason of chronic disability, according to annual family income and relief status.[a, b]

their prevalence. Although the data collected with respect to any particular chronic disease must be given careful scrutiny not practicable in this summary report, certain broad findings may be presented.

TABLE 8.—*Percentage of working population[a] reported to be "unemployable" by reason of chronic disability, classified by age and economic status*[b]

Annual family income and relief status	Percentage prevented from seeking work, in specified age groups					
	Total, 15-64	15-24	25-34	35-44	45-54	55-64
All incomes	1.10	.17	.42	1.08	1.78	3.99
Relief	2.87	.34	1.36	3.07	4.83	9.49
Nonrelief:						
Under $1,000	1.44	.18	.47	1.47	2.35	4.99
$1,000 to $1,500	.66	.11	.22	.64	1.09	2.68
$1,500 to $2,000	.46	.10	.19	.39	.73	1.85
$2,000 to $3,000	.39	.11	.19	.30	.50	1.58
$3,000 to $5,000	.28	.08	.08	.16	.39	1.18
$5,000 and over	.22	.10	.14	.11	.20	.78

Frequency of disabling illnesses classified as chronic.—Table 1 (item 7) shows that the annual frequency of illnesses disabling for a

week or longer in which the cause was a chronic disease (i. e., where the disease symptoms had been noticed for 3 months or longer) was 45 per 1,000 persons. In addition, about 60 percent of the illnesses with an impairment as the sole or primary diagnosis (item 8) had a disease as the underlying cause. (See table 2 for frequency rates of various chronic disease groups.)

Disability from chronic disease.—Table 1 (item 13) also shows that 6.3 days per person observed were lost annually from work or other usual pursuit by reason of chronic disease which disabled for a week or more. Again, 60 percent of the days of disability for illnesses with an impairment as the sole or primary diagnosis (item 14) had a disease as the underlying cause. (See figure 1 and table 2 for rates of disability of various chronic disease groups.)

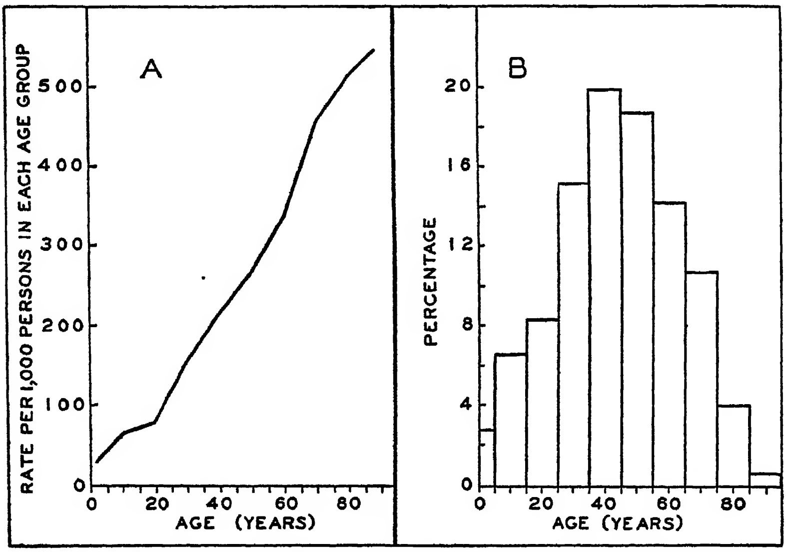

FIGURE 6.—(A) Proportion of persons in each age group reported to have a chronic[b] disease or impairment[c] and (B) percentage distribution by age.

Proportion of persons with a chronic disease or impairment.—In table 1 (item 3) is given the percentage of persons reported to have a chronic disease or impairment (17.7). A discussion of the subjective nature of this criterion has been given previously (p. 446). For purposes of relative comparisons this measure may be taken essentially as one of chronic disease, since the proportion in the group who had an impairment but not a chronic disease is nominal.[17]

In figure 6 and table 9 are presented the percentage distribution according to age of persons with a chronic disease or impairment and also the rate per 1,000 persons in each age group.

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[17] The percentage of persons with a chronic disease is about 15.6, as against the total rate of 17.7 (from a tabulation of a random sample of punched cards).

TABLE 9.—*Proportion of persons reported to have a chronic [b] disease or impairment [c] and percentage distribution, according to age [d]*

Age in years	Rate per 1,000 persons in each age group	Percentage distribution	Age in years	Rate per 1,000 persons in each age group	Percentage distribution
All ages	177	100 0	35-44	221	19 9
			45-54	274	18 8
Under 5	34	1 4	55-64	344	14 2
5-14	68	6.6	65-74	466	10 8
15-24	83	8.4	75-84	522	4 1
25-34	159	15 3	85 and over	557	.7

That chronic ailments are not merely a problem of old age is manifest. Half of the persons with a chronic disease or impairment were below 45 years of age, the greatest number being found in the age group 35–44. The rate of prevalence rises rapidly with age, but is by no means negligible in young and middle adult life.

Proportion of persons disabled for the whole 12 months immediately preceding the visit.—Equally interesting distributions for persons disabled for the full year under study are given in table 10. Although some persons in the group may be expected to recover their health, the number is probably more than counterbalanced by those who became permanently disabled during the 12-month period. Hence, the group may be regarded as representing an "invalid" population. Although the frequency rate rises rapidly with age, half of the "invalid" group was below the age of 55 years.

TABLE 10.—*Persons disabled for the entire 12 months immediately preceding the visit—frequency per 1,000 persons and percentage distribution according to age [a]*

Age in years	Rate per 1,000 persons in each age group	Percentage distribution	Age in years	Rate per 1,000 persons in each age group	Percentage distribution
All ages	11 7	100 0	35-44	10 8	14.6
			45-54	16 2	16 8
Under 5	1 6	1.0	55-64	28.5	17 9
5-14	3 1	4 6	65-74	55 0	19 2
15-24	4.6	7.1	75-84	76 1	9.1
25-34	5.7	8.0	85 and over	101.0	1.9

In table 11 this invalid population is classified according to the sole or primary diagnosis of the illness. Because of the incompleteness of the information on institutionalized cases, as brought out previously, the rates for nervous and mental diseases and for tuberculosis are too low. Syphilis, although in its later stages a major cause of invalidism, must be omitted because of incompleteness of reports for this disease in a house-to-house canvass. For the purpose of this table, cases with a sole or primary diagnosis of "orthopedic impairment" (233 per 1,000 persons) have been classified under the

reported cause of the impairment, thus giving a more complete picture of the disease causes of invalidism. The major diagnoses in the invalid group were cardiovascular-renal diseases, nervous and mental diseases, rheumatism and allied affections, permanent results of accidents, and tuberculosis.

TABLE 11.—*Proportion of persons disabled for entire 12 months immediately preceding visit, according to sole or primary diagnosis* [a]

Diagnosis [a]	Rate per 100,000 persons
All diagnoses	1,173
Cardiovascular-renal diseases	284
With permanent crippling effects	(94)
Nervous and mental diseases	216
Rheumatism and allied diseases	119
Permanent results of accidents	103
Senility and other and ill-defined diseases	68
Tuberculosis (all forms)	61
Blindness and diseases of eye	42
Chronic diseases of digestive system, not elsewhere classified	31
Diabetes mellitus	25
Chronic results of communicable disease	23
Infantile paralysis	(14)
Asthma	23
Cancer and other tumors	23
Chronic diseases of respiratory system, not elsewhere classified	19
Diseases of female genital organs	16
Diseases of gall bladder and liver	13
Ulcers of stomach and duodenum	13
Hernia	12
Congenital and early infancy causes	12
Diseases of bladder, urethra, urinary passages, and male genital organs	11
Deafness and diseases of ear	11
Anemia	10
Chronic diseases of skin and cellular tissue	8.1
Chronic bronchitis	7.4
Diseases of bones, joints, and organs of locomotion	6.8
Diseases of thyroid gland	6.7
Varicose veins	5.1

IMPAIRMENTS

Specific inquiry was made as to the presence of orthopedic impairments, blindness, and deafness, both disabling and nondisabling. Thus the survey yields a type of information which is unique for the general population. The figures represent, for these impairments, the permanent effects of disease and injury over the entire lifetime of living individuals in the surveyed population, and depend in part on changes in the risk.

Prevalence of orthopedic impairments.—About 2 percent of the population enumerated (18.8 per 1,000) were reported to have a permanent orthopedic impairment of such a serious nature that they were considered to be partially or completely crippled, deformed, or paralyzed. About 20 percent of this group were incapacitated throughout practically the whole year.[18] Table 12 gives the rate of prevalence for

[18] The rate of orthopedic impairments disabling for a week or more (sole, primary, and contributory diagnoses) was 3.5 per 1,000 persons. The word "incapacitated" is used in the text because of the long period of disability associated with disabling orthopedic impairments (344 days for sole and primary diagnoses within the 12 months preceding the visit, calculated from table 2).

specific impairments. Since, generally speaking, only one orthopedic impairment was coded for each individual, all references to total prevalent cases can also be considered as representing the total number of individuals affected.[19] It will be seen that the lost parts are mostly fingers, while the impaired members are usually "major", i. e., other than fingers or toes.

TABLE 12.—*Prevalence of specified orthopedic impairments per 1,000 persons* [a]

Member or part of body affected [a]	Total	Lost members	Impaired members
All parts	18.8	7.0	11.8
Major members:			
Entire body	.83	----------	.83
Foot (feet) or leg(s)	6.7	.95	5.7
Hand(s) or arm(s)	2.1	.51	1.6
Back, side, trunk, or head	2.7	----------	2.7
Fingers and toes:			
Finger(s)	6.0	5.1	.88
Toe(s)	.54	.45	.09

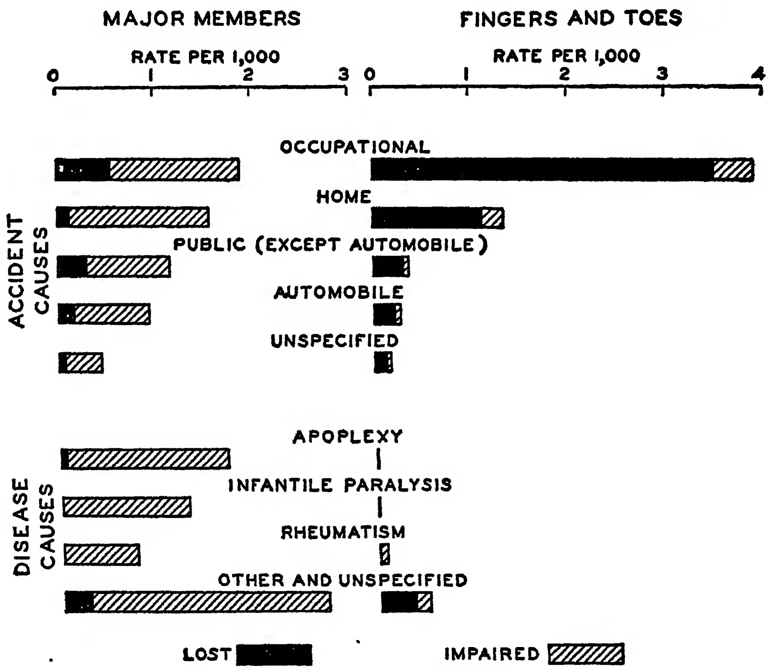

FIGURE 7.—Prevalence of orthopedic impairments according to their cause.[a, c]

Causes of orthopedic impairments.—The prevalence of orthopedic impairments according to their causes is given in figure 7 and table 13.

[19] It is obvious from the stub of table 12 that "one orthopedic impairment" may be inclusive of more than one member or part of the body. Limitations of the diagnosis code used necessitated the coding of a relatively few persons (0.55 per 1,000) as having two orthopedic impairments.

All impairments except those of fingers and toes have been combined as "major members," the separation being retained as to whether lost or impaired.

TABLE 13.—*Prevalence of orthopedic impairments per 1,000 persons according to their causes* [a]

Cause	All orthopedic impairments	Lost and impaired		Lost		Impaired	
		Major members	Fingers and toes	Major members	Fingers and toes	Major members	Fingers and toes
Total	18.8	12.3	6 5	1.5	5.6	10.8	96
Accidents	11.8	5.9	6.0	1.2	5.2	4.7	.75
Place of occurrence (not including automobile):							
Occupational	5 8	1.9	3 9	.56	3.5	1.3	.38
Home	2.9	1.6	1.3	.12	1.1	1 4	.23
Public	1 5	1 1	.37	28	.30	85	.07
Unspecified	.57	.41	.16	.06	13	35	.03
Automobile	1.1	91	.21	.16	.17	75	.04
Diseases [a]	7 0	6 4	.57	.28	.36	6 2	.21
Apoplexy	1 7	1.7	01	.03	.01	1 7	(1)
Infantile paralysis	1 3	1 3	01	(1)	(1)	1 3	.01
Rheumatism and allied diseases	.80	.75	06	.01	.01	.74	.05
Other and unspecified	3.2	2.7	50	24	.35	2 5	.15

[1] Rates less than 0.005.

Of the total number of orthopedic impairments reported, 63 percent were said to be due to accidents and 37 percent to disease. The important role of accidents in creating an impaired population is thus manifest. In the case of lost members, accidents were the cause in 90 percent, whereas for impaired members this percentage was 46; in the case of major members these percentages were 80 and 43, respectively.

For impairments due to accidents (with known place of occurrence), the percentages by place were: Occupational, 51; home, 26; public (including automobile), 23. For impairments affecting major members, these percentages were: Occupational, 35; home, 29; public (including automobile), 36. The different proportions in these two series are largely due to a high rate of lost fingers in occupational accidents.

Of the impairments due to accidents (with known place of occurrence), 10 percent were the result of automobile accidents. It will be realized that the population dealt with excludes any persons killed in automobile accidents. It is also to be noted that the population impaired by automobile accidents would be greater if the risk of today had been present over the entire lifetime of the persons under consideration.

Major disease causes of impairments were apoplexy, infantile paralysis, and rheumatic affections. It is notable that more than 1

in 1,000 persons in the general population were reported to be crippled (in some degree) as a result of infantile paralysis.

Prevalence of blindness.—Inquiry was made as to the number of persons in a given household who were blind in one or both eyes.[20] In this general report, data will be included only on those blind in both eyes. Although some cases of "economic," but not complete, blindness have no doubt been included, it is believed that the rate is essentially that of total or practically total blindness. The figure obtained in the survey was 83 per 100,000 persons.

The percentage distribution of these cases by age and the rate of prevalence in each age group is shown in table 14. It is interesting that half of the blind are below the age of 65. On the other hand, the prevalence rate at any given age rises from 12 per 100,000 in the age group under 15 to over 2,900 per 100,000 in the age group 85 and over.

TABLE 14.—*Blind persons (both eyes)—rate per 100,000 persons and percentage distribution by age* [a]

Age in years	Prevalence per 100,000 persons in each age group	Percentage distribution	Age in years	Prevalence per 100,000 persons in each age group	Percentage distribution
All ages	83	100.0	45–54	90	13.2
			55–64	187	16.5
Under 15	12	3.4	65–74	458	22.7
15–24	15	3.1	75–84	1,096	18.6
25–34	27	5.5	85 and over	2,916	7.6
35–44	49	9.4			

Impaired hearing.—Findings relative to impaired hearing, based on the Health Survey and a supplementary study, will be published separately.

ACCIDENTS

Table 2 shows that the annual frequency of illnesses disabling for a week or longer in which an accident was the sole or primary cause was 15.4 per 1,000 persons (9 percent of such illnesses). If to these cases are added those in which the accident was contributory to another diagnosis,[21] the rate becomes 16.0 per 1,000 persons. The latter type of rate will be employed in this discussion, as it forms a more complete statement of the incidence of accidents than that based on the sole and primary diagnoses.

Since accidents vary widely in severity, perhaps more than any other cause of illness, it is clear that only a small proportion of the

[20] The enumerator was not asked to inquire in regard to partial blindness, but was instructed to enter it when the information was volunteered.

[21] A small number of accident diagnoses contributory to another accident diagnosis have been included for convenience of tabulating. The rate of such cases was 0.25 per 1,000 persons (1.6 percent of accident

total number occurring during a year will cause disability for a week or more; however, it is convenient to have a line of demarcation for relative comparisons. Thus, the distribution of the more serious accidents, judged on this basis, by place of occurrence and means of injury, is of real interest. The rates per 1,000 persons for accidents disabling for a week or more, by place of occurrence and means of injury, are shown in table 15.

TABLE 15.—*Annual frequency of accidents disabling for a week or more*[a] *per 1,000 persons, by place of occurrence and means of injury*[a]

Means of injury[d]	Place of occurrence				
	Total	Home	Public	Occupational	Unspecified
Total	16 0	4 7	6 4	3 9	95
Falls by persons	5 7	2 6	2 2	94	02
Automobiles	3 2	04	3 0	14	.01
Poisonings	65	07	02	06	.50
Burns	60	38	03	17	.03
Cutting or piercing instruments	59	27	09	22	01
Machinery	47	10	01	36	(1)
Transportation (except automobile)	29	01	.19	08	(1)
All other known means	53	10	16	07	20
Unspecified means	3 9	1 1	.76	1 9	.18

[1] Less than 005.

Of the accidents with known place of occurrence, 43 percent occurred in public places, 31 percent occurred in the home, and 26 percent were occupational.

The percentage of accidents due to different means of injury was as follows: Falls, 47; automobile, 26; poisonings, 5.4; burns, 5.0; cutting and piercing instruments, 4.9; machinery, 3.9; transportation (except automobile), 2.4; other known, 4.4.

SUMMARY

The present report summarizes the illness data collected in a house-to-house canvass of more than 700,000 urban families (2,500,000 white and colored persons) in 18 States, made from November 1935 to March 1936. Because of the recognized impossibility of complete enumeration of illness, some of the rates given are somewhat below the true values.

General rates.—Four and one-half percent of the persons were disabled on the day of the canvass, including one-fourth of this number who had been disabled for the entire 12 months immediately preceding the visit. Eighteen percent were reported as having a chronic disease or impairment.

The annual frequency of illness disabling for a week or longer (including hospital cases, confinements, and fatal illnesses of any duration of disability) was 171 cases per 1,000 persons. The number of

days of disability per person observed per year was 10; and the number of days per case was 58.

One percent of workers aged 15–64 were reported to be "unemployable" by reason of disability.

Diagnosis.—The most common causes of illnesses disabling for a week or longer during a year were respiratory in nature (colds, influenza, tonsillitis, pneumonia, tuberculosis). Second in rank were the common communicable diseases of childhood. With respect to total days of disability, the cardiovascular-renal group ranked first and the group of nervous and mental diseases second.

Illness in particular age groups.—By age the annual frequency of illnesses disabling for a week or more was: Under 15, 214; 15–24, 131; 25–64, 153; 65 and over, 279. The corresponding values for days of disability per person were 5.7, 5.4, 10.5, 36.1.

Income, employment status, and illness.—The annual frequency of illnesses disabling for a week or more was much higher in the relief and low-income groups than in the groups above $1,500. In terms of volume of disability the contrast was even greater, the excess over the highest income group ($5,000 and over) being 132 percent and 68 percent, respectively, for the relief group and the next lowest income group. The change with income was most marked in the productive period of life. Chronic diagnoses showed the most marked differences in relative volume of disability between the low and high income groups, particularly hernia, tuberculosis, varicose veins, and blindness and deafness.

The unemployed workers had much higher illness rates than the employed. In the ages 15–64, 1.7 percent of the employed were disabled on the day of the visit, as against 3.6 for the unemployed workers.

There was a marked concentration in the low-income group of persons who were reported to be "unemployable" by reason of disability. In relief families the percentage of workers so classified was 2.9; in nonrelief families with incomes under $1,000 it was 1.4. The proportion continued to decrease with rising family income, reaching 0.22 in the group with incomes of $5,000 and over.

Chronic disease.—Six and a half days per person per year were lost from work or other usual pursuit by reason of illnesses due to chronic diseases which disabled for a week or longer, or two-thirds of the total amount of disability of this minimum duration. The annual frequency of such illnesses was 45 per 1,000 persons.

Chronic disease is not merely a problem of old age—half of the persons with a chronic disease or impairment were below 45 years of age. In the case of "invalids" (persons disabled for 12 months immediately preceding the visit), half were below the age of 55. The major diagnoses in the "invalid" group were cardiovascular-renal diseases,

nervous and mental diseases, rheumatism and allied affections, permanent results of accidents, and tuberculosis.

Impairments.—About 2 percent of the population enumerated were reported to have a permanent orthopedic impairment of such serious nature that they were considered to be partially or completely crippled, deformed, or paralyzed. About 20 percent of this group were incapacitated throughout practically the whole year. Of the total number of orthopedic impairments reported, 63 percent were due to accidents and 37 percent to disease. Of those due to accidents (with known place of occurrence), the percentages by place were: Occupational, 51; home, 26; public (including automobile), 23. Ten percent were the result of automobile accidents. Major disease causes of impairments were apoplexy, infantile paralysis, and rheumatic affections.

A rate of 83 per 100,000 persons was obtained for total or practically total blindness in both eyes, half of the cases being below the age of 65.

Accidents.—The annual frequency of accidents disabling for a week or more over the period of a year was 16 per 1,000 persons. The percentage distribution of such accidents by known place of occurrence was public, 43; home, 31; and occupational, 26. Falls were the most common means of injury, being responsible in 47 percent of all cases with known means. Twenty-six percent of accidents disabling for a week or longer were automobile accidents.

Appendix

REFERENCES TO TABLES AND CHARTS

(These references are to be considered as supplementary to the basic description of the National Health Survey technique and definitions which have been given in "Scope and method of a Nation-wide canvass of sickness in relation to its social and economic setting," by George St. J. Perrott, Clark Tibbitts, and Rollo H. Britten, Pub. Health Rep., 54: 1663 (1939).)

[a] Based on 2,502,391 persons in 83 cities, distributed by age (years) as follows:

Under 5	175, 653	35–44	395, 525	75–84	34, 857
5–14	427, 161	45–54	303, 008	85 and over	5, 385
15–24	446, 369	55–64	182, 754	Unknown	4, 211
25–34	425, 301	65–74	102, 167		

[b] "Chronic" refers to illnesses the disease symptoms of which had been observed for at least 3 months before the day of visit.

[c] "Impairment" includes impaired or lost members, deafness and blindness. (A person may have had more than one chronic disease and/or impairment.)

[d] Based on 12,512 punch cards selected at random (every 200th card) from among those for 2,502,391 persons in 83 cities. (See [a] above.)

[e] Includes some cases which had been disabled for less than 1 week, *viz*, fatal cases, confinements, and hospitalized cases. (See footnote 9 of text.)

[f] Based on 2,350,951 persons of known age and known annual family income in 83 cities. Limited to cases and persons within the following definition:

Geographic region	Size of city	Color
Northeast and North Central	500,000 and over	All.
Do	Under 500,000	White only
South	All	White and Negro only.
West	do	White only

Such persons are distributed by age (years) and annual family income as follows:

	Under 15	15–24	25–64	65 and over
Relief	147, 984	79, 226	181, 030	21, 211
Nonrelief[i]				
Under $1,000	126, 250	99, 976	290, 732	45, 227
$1,000 to $1,500	129, 087	92, 128	283, 296	25, 843
$1,500 to $2,000	86, 842	67, 947	218, 821	17, 923
$2,000 to $3,000	55, 301	48, 562	160, 314	13, 565
$3,000 to $5,000	18, 867	19, 870	64, 984	6, 148
$5,000 and over	7, 793	8, 401	30, 020	3, 603

[g] Based on cases with known duration of disability. (Those with unknown duration of disability amount to only 0.4 percent of all cases.)

[h] Calculated according to the formula $\frac{100\,D}{W+D}$,

where D=number of persons in the general population (see [i] below) who were, because of chronic disease or impairment, prevented from seeking work, and

W=number of workers. (See [j] below.)

[i] Based on 982,440 persons of known annual family income in 83 cities (see [h] above), distributed by age (years) and annual family income as follows:

	15–24	25–34	35–44	45–54	55–64
Relief	41, 974	35, 958	35, 130	27, 680	15, 051
Nonrelief					
Under $1,000	50, 985	64, 879	56. 798	42, 075	24, 974
$1,000 to $1,500	45, 894	64. 226	53, 798	36, 965	18, 615
$1,500 to $2,000	35, 316	40, 993	41, 778	29, 982	14, 477
$2,000 to $3,000	25, 673	33, 918	30, 562	22, 722	11, 522
$3,000 to $5,000	10, 558	13, 626	11, 772	10, 029	5, 501
$5,000 and over	3, 960	5, 827	5, 306	4, 952	2, 964

[j] Sole or primary diagnoses grouped as follows:

Common communicable diseases of childhood: Measles, mumps, chickenpox, whooping cough, scarlet fever, German measles, diphtheria.

Other communicable diseases: Malaria, erysipelas, typhoid fever, smallpox, local infections, other infectious and parasitic diseases, except tuberculosis and influenza.

Cancer and other tumors: Malignant and nonmalignant tumors.

Diabetes mellitus.

Rheumatism and allied diseases: Rheumatism, arthritis, gout, neuralgia, neuritis, lumbago, acute rheumatic fever, stiff neck, and other muscular pains.

Cardiovascular-renal diseases: Heart diseases (including diseases of coronary arteries), arteriosclerosis, hypertension, cerebral hemorrhage, kidney diseases, current paralysis except paresis.

Nervous and mental diseases: Neurasthenia, nervous breakdown, epilepsy, chorea, locomotor ataxia, paresis, insanity, other diseases of the nervous system.

Diseases of ear and mastoid process.

Tuberculosis: All forms of tuberculosis.

Pneumonia: All forms of pneumonia (not including hypostatic pneumonia).

Tonsillitis: Including quinsy, tonsillectomies, and adenoidectomies.

Other diseases of respiratory system: Influenza, grippe, colds, bronchitis, sinusitis, throat affections other than those of the tonsils, pleurisy, asthma, hay fever, other diseases of the respiratory system.

Appendicitis: Including appendectomies.

Hernia.

Diseases of the teeth, mouth, and gums: Including toothache.

Other diseases of digestive system: Ulcers of the stomach or duodenum, indigestion, biliousness, diarrhea, enteritis, colitis, gall bladder and liver diseases, other digestive diseases.

Diseases of thyroid gland: All types of goiter and thyroid and parathyroid diseases.

Anemia: All forms of anemia.

Hemorrhoids.

Varicose veins: Varicose veins or ulcers, varicocele.

Diseases of bladder, urethra, urinary passages, and male genital organs: Including prostatitis and circumcision; excludes venereal diseases.

Diseases of female genital organs and complications of pregnancy: Menstrual disorders including menopause, cysts of ovaries, uterus, and tubes, diseases of breast, other diseases of female genital organs and diseases and toxemias of pregnancy without loss of fetus; excludes venereal diseases, cancer, and other tumors.

Confinements: Live births, stillbirths, miscarriages, abortions, ectopic pregnancies.

Diseases of skin and cellular tissue: Abscesses, ulcers, boils, impetigo, eczema, scabies, itch, urticaria, other diseases of the skin and cellular tissue.

Accidents: Accidents of all types; excludes suicides and homicides and attempted suicides and homicides.

Orthopedic impairments: Orthopedic impairments of all types.

Blindness and deafness: Including blindness in one eye and deaf-mutism.

Other and ill-defined causes: All diagnoses not included above (particularly, other diseases of the circulatory system, diseases of the lymphatic system, eyes, bones, joints, organs of locomotion, congenital malformations, and diseases of early infancy).

[k] Exclusive of persons who had been in institutions for the care of disease or impairment for the entire 12 months (or longer) immediately preceding the visit.

[l] "Employed worker" is a person engaged in regular (not work relief) full- or part-time gainful employment on the day of the visit, without regard to whether he was, on that day, actually at work, not required to be at work, on strike, or temporarily disabled because of illness.

"Unemployed worker" is a person who was reported as seeking work on the day of the visit whether or not he had previously been employed (or if temporarily disabled because of illness on that day, would seek work upon recovering sufficiently to be able to do so) or a person who was on work relief on the day of the visit.

Persons who were, because of chronic disease or impairment, prevented from seeking work, are not included as "workers."

[m] Based on 971,620 workers (see [l] above) aged 15–64 years in families with known annual income in 83 cities, distributed by age (years) and employment status as follows:

	15–24	25–44	45–64
Employed	138, 958	413, 956	203, 688
Unemployed	75, 043	82, 974	57, 001

In the calculation of the rates, workers who had claimed workmen's compensation are excluded from the numerator; this exclusion was made to facilitate tabulation and does not change the comparisons since only 0.1 percent of all workers are affected.

[a] Causes of disability grouped as follows:

Cardiovascular-renal diseases: Heart diseases (including diseases of coronary arteries), arteriosclerosis, hypertension, cerebral hemorrhage, kidney diseases, current paralysis except paresis. "With permanent crippling effects" refers to cases reported by the family informant as having an orthopedic impairment.

Nervous and mental diseases: Neurasthenia, nervous breakdown, epilepsy, chorea, locomotor ataxia, paresis, other diseases of the nervous system.

Rheumatism and allied diseases: Rheumatism, arthritis, gout, neuralgia, neuritis, lumbago, acute rheumatic fever, stiff neck, and other muscular pains.

Permanent results of accidents: Impairment or loss of members resulting from accidents which occurred more than 12 months prior to the visit. Attempted suicides and homicides are not considered to be accidents.

Senility and other ill-defined diseases: Senility, debility, asthenia, fatigue, exhaustion, malnutrition, aneurysm (except of the heart), gangrene, diseases of circulatory system not elsewhere classified, hemorrhoids, pellagra, diseases of lymphatic system, results of attempted suicides and homicides, other general, ill-defined or unknown causes.

Tuberculosis: All forms of tuberculosis.

Blindness and diseases of eye: Including blindness in one eye.

Chronic diseases of digestive system not elsewhere classified: Indigestion, biliousness, diseases of mouth, teeth, and gums; diarrhea, enteritis, appendicitis, other and ill-defined stomach diseases; and other and ill-defined diseases of the digestive system. Excludes diseases of the gall bladder and liver, hernia, and ulcers of the stomach or duodenum.

Diabetes mellitus.

Chronic results of communicable disease: Infantile paralysis, other communicable diseases.

Asthma.

Cancer and other tumors: Malignant and nonmalignant tumors.

Chronic diseases of respiratory system not elsewhere classified: Sinusitis, pleurisy, throat affections, pneumonia, colds, influenza, grippe, hay fever, other diseases of the respiratory system not elsewhere classified. Excludes tuberculosis, asthma, and bronchitis.

Diseases of female genital organs: Menstrual disorders including menopause, complications of childbirth and pregnancy, diseases of the breast, other and ill-defined diseases of the female genital organs. Excludes venereal diseases, cancer, and other tumors.

Diseases of gall bladder and liver.

Ulcers of stomach and duodenum.

Hernia.

Congenital and early infancy causes: Congenital malformations or deformities including those of the heart, congenital debility, pyloric stenosis, injury at birth, other early infancy causes.

Diseases of bladder, urethra, urinary passages, and male genital organs: Excludes venereal diseases.

Deafness and diseases of ear, including deaf-mutism.

Anemia: All forms of anemia.

Chronic diseases of skin and cellular tissue: Abscesses, ulcers, boils, impetigo, eczema, scabies, itch, uticaria, other diseases of the skin and cellular tissue.

Chronic bronchitis.

Diseases of bones, joints, and organs of locomotion: Excludes lumbago, myalgia, and other muscular pains.

Diseases of thyroid gland: All types of goiter and thyroid and parathyroid diseases.

Varicose veins: Varicose veins or ulcers, varicocele.

[a] Based on 2,498,180 persons of known age in 83 cities. (See [a] above.)

[p] When more than one member or part of the body was lost or impaired the following rules (for the purpose of this article) were applied:

(1) For a combination of lost part(s) *and* impaired part(s), in general (see footnote 19 to text), only the lost part(s) is shown.

(2) For combinations of lost parts only and for combinations of impaired parts only, selection of the impairment to be shown was based on the order in table 12; for instance, combinations of a lost foot and a lost arm would be shown only under "lost foot."

Back, side, trunk, or head: Includes spine, shoulder, chest, skull, and face.

Joints in the hand, wrist, elbow, or shoulder are classified as impaired hand(s) or arm(s); joints in the foot, ankle, knee, or hip as impaired foot (feet) or leg(s).

[q] Apoplexy, including embolism, thrombosis, softening of the brain, arteriosclerosis, hypertension, and paralysis.

Rheumatism and allied diseases, including arthritis, gout, neuralgia, and lumbago.

Other and unspecified causes: In the order of their frequency, weakness of arch(es) (foot); tuberculosis, osteomyelitis, and other diseases of the bones and joints; abscesses, local infections, and septicemia; diabetes and gangrene; other infectious and nervous system diseases, including meningitis and encephalitis; cancer and tumors; etc.

[r] Automobile (as a means of injury) refers to any accident in which an automobile was involved, including collisions with trains, streetcars, and pedestrians.

Poisoning: Poisoning by food, chemicals, drugs, plants, gas, etc.

Machinery: Includes accidental traumatism in mines and quarries.

Other means of injury: In the order of their frequency, attack by animals, venomous and other; excessive heat or cold; firearms, except when used in war; etc.

Injuries from attempted suicides and homicides are not classified as accidents.

SANITARY UNITS ON SHIPS[1]

ORGANIZATION AND OPERATION

By G. C. SHERRARD, *Acting Assistant Surgeon, United States Public Health Service*

In the past the problem of ship sanitation has been principally the concern of the Federal Government whose representatives inspected the vessels at various intervals while in port. Since the greater part of a ship's life is spent at sea it is evident that the maintenance of satisfactory sanitary conditions on board is a joint responsibility in which the officers and crew play the major role. The development

[1] This paper is based upon an outline prepared by Sanitary Inspector Louis Lindecop of the New York Quarantine Station, where the organization described is in effective operation at present.

of this responsibility, applicable to all vessels, has been intensified by the inauguration of radio pratique, whereby selected passenger vessels are permitted to enter certain United States ports without stopping for the customary quarantine inspection. As the granting of this privilege is premised on the maintenance of acceptable sanitary conditions on the vessel, this article is presented in the hope that owners and operators of all vessels will avail themselves of the benefit of this or similar plans to the end that their vessels may be maintained in a satisfactory sanitary condition, thereby avoiding any quarantine delay and expense resulting from or incident to insanitary conditions.

In order to attain desired sanitary objectives a system has been devised whereby the responsibility for the maintenance of a satisfactory sanitary status is placed upon certain members of a vessel's personnel while at sea, reinforced by specialized personnel while in port. Under this plan a sanitary inspector, representing the United States Public Health Service, inspects a vessel upon arrival in a United States port at least once in 90 days, making such recommendations for the correction of insanitary conditions as may be indicated. During an inspection each organized department of the vessel is visited, in company with the head of the department; each compartment is inspected and conditions such as dirt, waste food, rubbish, improperly handled garbage, excess gear and dunnage, and evidence of insect or rodent infestation are noted and recommendations made for their correction.

The ship sanitation organization effected by some of the large steamship lines at the port of New York is shown in figure 1.

Under this plan the chief officer of the vessel is the directing head of the organization at sea, operating through a sanitary officer appointed from among the junior deck officers. This sanitary officer makes periodical inspections of the vessel, reporting to the chief officer insanitary conditions and the progress made in correcting defects previously reported.

Each department head then designates a trustworthy member who is charged with the responsibility of maintaining the various sections of his own department in a clean and sanitary condition and also insuring their freedom from insect and rodent infestation. This personnel, together with the junior and chief officer, comprise the sanitary unit of a vessel.

Upon completion of a voyage the chief officer renders a written report on the sanitary condition of the vessel, stating what special measures were applied during the voyage, the sections in which the work was done, and listing the sections, if any, in which rodent or vermin infestation is known to exist. This report is given to the shore officials of the line and a copy is kept on the ship for the information of the Public Health Service.

The sanitary inspector representing the steamship lines is usually a full-time employee who, in addition to his regular duties, is charged with the supervision of the sanitary problems of the vessel while in port. He either has had experience with the various problems of ship sanitation or is capable of learning the essentials within a short training period. He can be made responsible to any department of the company but it is desirable that he operate under the medical department, when such an organization exists. His duties are to

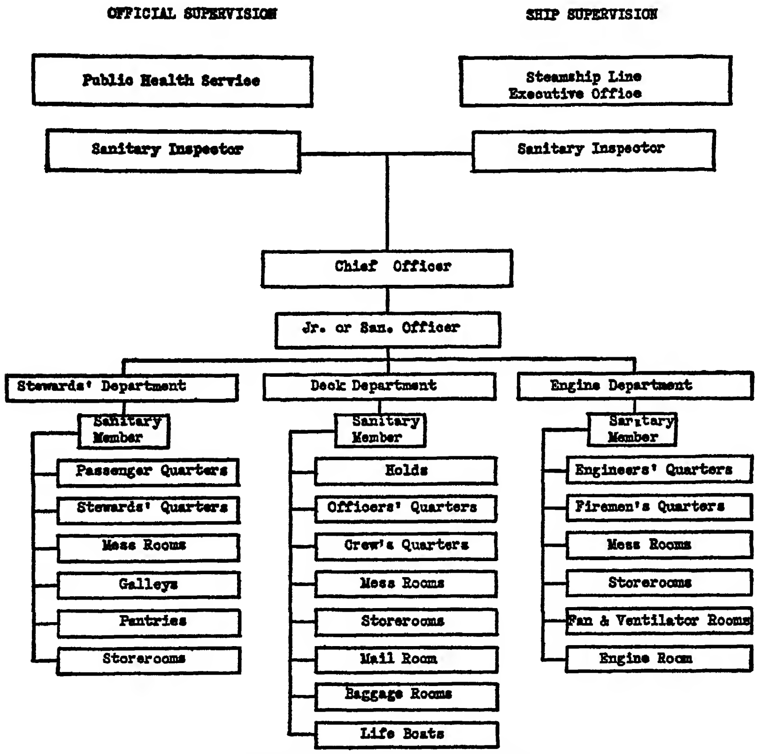

FIGURE 1.—Ship sanitation organization.

assume full and complete charge of the following sanitary work while the vessel is in port:

1. The proper fending off dock and the placing of effective rat guards on all lines.
2. The proper collection, protection, and disposal of garbage.
3. The systematic inspection of the vessel for insanitary conditions, rodent and insect infestation.
4. The institution of measures for the correction of any insanitary condition, guidance being afforded by the chief officer's report. In addition to transmitting the chief officer's sanitary report to the proper line official, he should supplement it with a concise report of his own.

5. Contact with the Public Health Service representative during that official's tour of inspection and cooperation in carrying out the recommendations made.

6. The reporting to the chief officer, prior to the vessel's departure, of uncorrected conditions, these to be remedied while the vessel is at sea.

The plan of sanitary organization as outlined may be contracted, expanded, or otherwise changed, as conditions warrant, so long as the steady flow of sanitary information from the vessel to the operating executives of the steamship line and the Public Health Service is maintained, with corrective measures flowing in the opposite direction. The three key positions in this set-up are the chief officer, the shore sanitary inspector of the steamship company, and the United States Public Health Service inspector.

SKIN HAZARDS IN AMERICAN INDUSTRY, PART III[1]

A Review

This is the third of the series of publications on the studies of skin hazards in American industry made in factories by the Office of Dermatoses Investigations of the United States Public Health Service.

Studies made in 11 industries are included in this bulletin.

1. Studies were made in the citrus fruit industry in Florida and California, and the skin hazards from fertilizers, insecticides, thorns, citrus juices, and oils are discussed. No cases of dermatitis were found to be due to the dyes used on citrus fruit.

2. Studies on cigar manufacture were made in Pennsylvania and Florida. Skin hazards in this industry are very few and there were no cases of hypersensitivity found that were due to tobacco alone.

3. Acids are divided into organic and inorganic, and a brief description of their manufacture is given. The skin hazards in their use are discussed.

4. The skin hazards in pulp and paper manufacture consist principally of alkali burns.

5. The skin hazards in the manufacture of various organic solvents are discussed. These solvents cause dermatitis because of their property of extracting fat from the skin. Particular attention is paid to turpentine manufacture and the skin lesions caused by it.

6. In the manufacture of chromic acid and the chromates, ulceration of the skin and of the nasal mucous membranes is quite common. Dermatitis due to hypersensitivity to the chromates is not so common.

7. The skin hazards in iron and steel manufacture consist of burns and intertrigo due to heat, acid burns from the pickling solutions,

[1] Public Health Bulletin No. 249, same title as above. By Louis Schwartz. Available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents per copy.

and alkali burns from the lime used in pickling and cutting compounds. Folliculitis and boils occur from petroleum oils used on various kinds of machinery.

8. Dermatitis from paints, varnishes, and lacquers is usually caused by hypersensitivity to vegetable oils, by volatile solvents used as thinners, alkalies and acids used as paint removers, and but very rarely from pigments and dyes.

9. In the manufacture of glass, dermatitis occurs from alkalies and arsenic. Various stigmata, such as calluses, and deformities of the teeth are also observed.

10. The skin hazards in photographing, photoengraving, and the like, are usually from the developers and the cleaning solutions used by the workers to remove chemicals from their hands. Authentic cases of dermatitis from carbon paper, typewriter ribbons, and hectograph inks are exceedingly rare.

11. Dermatitis in the manufacture of explosives has been greatly reduced since the World War. Worthy of note is the occurrence of symptoms of chronic alcoholism among munition workers exposed to the fumes of alcohol used in the manufacturing of gun cotton, and the occurrence of a blue line on the gums resembling that of lead poisoning in workers exposed to the action of TNT.

Methods of prevention and an extensive bibliography are included. The bulletin contains 22 illustrations.

DEATHS DURING WEEK ENDED FEBRUARY 24, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Feb. 24, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,409	10,096
Average for 3 prior years	9,597	
Total deaths, first 8 weeks of year	77,350	75,540
Deaths under 1 year of age	490	589
Average for 3 prior years	597	
Deaths under 1 year of age, first 8 weeks of year	4,333	4,433
Data from industrial insurance companies:		
Policies in force	66,131,396	68,013,875
Number of death claims	12,624	12,447
Death claims per 1,000 policies in force, annual rate	10.0	9.5
Death claims per 1,000 policies, first 8 weeks of year, annual rate	10 4	10.0

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MARCH 9, 1940

Summary

For the week ended March 9, 1940, the incidence of each of the 9 important communicable diseases reported weekly to the Public Health Service by the State health officers was below the median expectancy based on the median for the corresponding week of the 5-year period 1935–39. For the first time this year the weekly influenza incidence dropped below the 5-year median, and for the second time this year the weekly incidence of poliomyelitis was below the median expectancy.

For the current week, 9,590 cases of influenza were reported, as compared with 11,533 for the preceding week and with 11,131 for the median week of the preceding 5 years. All geographic areas which have been reporting the largest numbers of cases registered declines for the current week, with the exception of the East North Central group, where the number of cases reported from Wisconsin increased from 173 to 420.

As compared with the preceding week, increases are shown in the current reports for diphtheria, measles, smallpox, typhoid fever, and whooping cough. Of the total of 94 cases of smallpox reported during the current week, 42 cases were reported in Oklahoma.

Current reports include 19 cases of endemic typhus fever (7 in South Carolina), 1 case of tularaemia (in Maryland), and 5 cases of undulant fever (all in the South and Eastern States).

Telegraphic morbidity reports from State health officers for the week ended March 9, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 9, 1940	Mar. 11, 1939		Mar. 9, 1940	Mar. 11, 1939		Mar. 9, 1940	Mar. 11, 1939		Mar. 9, 1940	Mar. 11, 1939	
NEW ENG.												
Maine	1	6	2	1	103	103	236	16	147	1	1	0
New Hampshire	0	0	0	------	------	------	140	2	16	0	0	0
Vermont	0	0	0	------	------	------	7	19	19	0	0	0
Massachusetts	2	4	4	------	------	------	266	815	810	2	0	2
Rhode Island	0	0	1	------	1	------	161	9	39	1	0	0
Connecticut	3	1	2	9	141	26	238	595	595	0	0	0
MID. ATL.												
New York	17	37	37	[1] 40	[1] 57	[1] 47	467	1,482	1,891	2	7	11
New Jersey	7	7	14	13	19	28	183	41	1,058	0	1	3
Pennsylvania	35	44	47	------	------	------	221	174	776	6	8	6
E. NO. CEN.												
Ohio	22	17	21	36	------	28	27	16	258	2	0	9
Indiana	9	16	18	86	315	82	12	5	15	1	0	3
Illinois	23	33	36	56	838	71	58	23	57	1	3	5
Michigan [2]	5	8	12	12	674	6	319	373	373	1	1	1
Wisconsin	4	0	3	420	1,516	91	377	781	781	1	0	0
W. NO. CEN.												
Minnesota	1	9	5	4	40	2	240	1,046	272	0	0	1
Iowa	4	5	4	28	695	8	328	290	163	0	1	1
Missouri	11	6	21	8	673	243	8	14	63	0	1	3
North Dakota	2	1	4	36	741	6	6	113	0	0	1	0
South Dakota	1	1	1	1	50	1	2	146	14	0	0	0
Nebraska	2	1	3	7	1	1	33	38	38	0	2	1
Kansas	11	2	4	29	226	43	522	49	49	1	0	0
SO. ATL.												
Delaware	0	2	2	------	------	0	1	0	28	0	0	0
Maryland [2]	2	7	7	53	53	64	5	1,020	195	0	1	2
Dist. of Col.	6	1	9	------	11	4	0	30	30	0	1	3
Virginia	18	21	12	1,182	1,091	------	48	421	401	1	2	4
West Virginia	11	7	8	893	71	135	10	15	15	4	2	5
North Carolina [3]	14	13	14	116	380	278	170	1,088	607	0	1	2
South Carolina [3]	7	4	4	766	1,142	1,005	18	36	14	1	2	2
Georgia [3]	3	5	13	287	420	420	156	192	0	0	1	1
Florida [3]	5	8	8	26	3	20	137	46	36	1	0	0
E. SO. CEN.												
Kentucky	8	9	14	83	1,792	103	56	102	102	1	1	6
Tennessee	4	2	11	201	469	452	117	117	89	1	0	4
Alabama [3]	13	9	0	501	1,126	1,126	174	396	396	1	0	4
Mississippi [2] [3]	6	5	5	------	------	------	------	------	------	2	1	1
W. SO. CEN.												
Arkansas	5	11	8	501	1,532	260	6	39	39	0	0	1
Louisiana	7	25	18	135	82	82	5	201	70	0	2	2
Oklahoma	4	7	11	353	387	337	7	257	83	0	0	9
Texas [3]	34	38	54	2,834	968	1,279	745	139	309	2	1	5
MOUNTAIN												
Montana	9	2	2	8	125	23	28	494	80	0	0	0
Idaho	1	0	0	2	14	5	58	59	29	2	3	0
Wyoming	0	1	0	10	8	------	39	7	12	1	0	0
Colorado	4	12	9	30	136	------	25	200	200	1	0	0
New Mexico	0	1	2	3	677	9	9	27	44	0	0	0
Arizona	4	11	2	273	191	105	42	38	42	0	2	0
Utah [3]	1	1	0	9	119	------	264	145	23	0	0	0
PACIFIC												
Washington	0	3	3	3	3	3	930	560	207	0	0	2
Oregon	2	1	0	42	261	144	471	41	41	0	0	1
California [3]	20	28	32	411	73	377	417	3,504	598	2	4	7
Total	348	431	524	9,590	18,135	11,131	7,789	15,224	15,224	39	52	174
10 weeks	4,064	5,370	6,327	133,764	69,182	69,182	52,598	121,348	121,348	390	533	1,161

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 9, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	Mar. 9, 1940	Mar. 11, 1939		Mar. 9, 1940	Mar. 11, 1939		Mar. 9, 1940	Mar. 11, 1939		Mar. 9, 1940	Mar. 11, 1939	
NEW ENG.												
Maine	0	0	0	13	20	17	0	0	0	0	4	0
New Hampshire	0	0	0	2	9	13	0	0	0	0	0	0
Vermont	0	0	0	23	15	17	0	0	0	0	0	0
Massachusetts	0	0	0	140	219	256	0	0	0	1	1	1
Rhode Island	0	0	0	16	5	15	0	0	0	0	0	0
Connecticut	0	0	0	69	111	111	0	0	0	2	1	0
MID ATL.												
New York	1	0	1	933	747	952	0	0	0	2	6	6
New Jersey	0	0	0	380	161	166	0	0	0	1	4	2
Pennsylvania	1	1	0	430	649	675	0	0	0	[4] 7	7	6
E. NO. CEN.												
Ohio	0	1	1	307	511	471	0	27	2	3	1	3
Indiana	0	1	0	288	224	237	2	33	3	1	1	0
Illinois	0	1	2	655	543	888	3	9	22	3	3	5
Michigan [3]	0	0	0	299	609	609	0	14	1	5	1	2
Wisconsin	4	1	0	149	238	379	6	10	10	3	0	1
W. NO. CEN.												
Minnesota	0	0	0	98	121	153	12	7	7	0	0	0
Iowa	0	0	0	65	198	198	4	31	31	1	0	1
Missouri	0	0	0	70	93	195	8	11	11	2	10	5
North Dakota	0	0	0	25	13	53	1	0	3	0	2	0
South Dakota	0	0	0	13	26	40	0	8	8	0	1	0
Nebraska	0	0	0	26	41	57	1	19	17	0	0	0
Kansas	0	0	0	82	127	207	1	0	26	0	1	1
SO. ATL.												
Delaware	0	0	0	14	0	10	0	0	0	1	0	0
Maryland [3]	0	0	0	57	41	74	0	0	0	3	0	2
Dist. of Col.	0	0	0	35	15	24	0	0	0	0	2	0
Virginia	0	1	0	61	36	36	0	0	0	3	3	2
West Virginia	1	0	0	56	48	49	0	1	0	3	9	3
North Carolina [3]	0	0	0	61	57	41	0	0	0	1	6	3
South Carolina [3]	0	1	0	5	8	5	0	0	0	0	6	3
Georgia [3]	1	0	0	22	17	12	1	0	0	2	2	1
Florida [3]	0	0	0	10	16	8	0	0	0	[4] 5	1	1
E. SO. CEN.												
Kentucky	0	1	1	69	96	72	0	1	1	4	3	3
Tennessee	0	0	0	76	49	30	0	2	2	0	0	2
Alabama [3]	2	0	1	13	23	17	0	0	0	1	2	2
Mississippi [2,3]	0	3	1	7	5	8	1	0	0	1	1	1
W. SO. CEN.												
Arkansas	0	0	0	7	15	12	5	2	2	1	6	2
Louisiana	0	0	0	26	14	14	0	1	2	2	56	13
Oklahoma	0	1	0	15	33	33	42	47	3	0	3	3
Texas [3]	0	1	1	52	79	112	0	30	28	3	8	9
MOUNTAIN												
Montana	0	0	0	42	25	36	0	0	7	0	0	0
Idaho	0	0	0	15	30	19	1	6	4	0	1	1
Wyoming	0	0	0	9	11	19	0	0	2	1	1	0
Colorado	0	0	0	43	44	45	1	16	3	0	0	0
New Mexico	0	1	0	11	34	30	0	1	0	0	1	0
Arizona	0	0	0	4	12	12	0	10	0	1	0	0
Utah [2]	0	0	0	17	31	57	0	0	0	1	0	0
PACIFIC												
Washington	0	1	0	35	67	67	0	0	14	0	1	2
Oregon	0	0	0	23	59	54	0	19	19	3	0	0
California [3]	2	1	1	156	273	266	5	21	11	2	3	4
Total	12	16	17	5,024	5,818	7,739	94	326	285	69	158	106
10 weeks	287	161	211	45,937	53,966	65,463	734	3,923	2,942	[4] 739	1,195	1,173

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 9, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough — Week ended— Mar. 9, 1940	Whooping cough — Week ended— Mar. 11, 1939
NEW ENG.		
Maine	50	53
New Hampshire	10	5
Vermont	25	30
Massachusetts	178	187
Rhode Island	9	30
Connecticut	20	89
MID. ATL.		
New York	404	575
New Jersey	108	412
Pennsylvania	472	482
E. NO. CEN.		
Ohio	138	110
Indiana	40	29
Illinois	138	336
Michigan [2]	115	206
Wisconsin	113	251
W. NO. CEN.		
Minnesota	33	55
Iowa	23	18
Missouri	27	17
North Dakota	8	6
South Dakota	2	2
Nebraska	3	5
Kansas	38	23
SO. ATL.		
Delaware	8	3
Maryland [2]	250	14
Dist. of Col	24	36
Virginia	36	38
West Virginia	32	50
North Carolina [3]	95	336
SO. ATL.—continued		
South Carolina [3]	15	85
Georgia [3]	38	59
Florida [3]	14	57
E. SO. CEN.		
Kentucky	72	9
Tennessee	36	55
Alabama [3]	23	20
Mississippi [2 3]	----------	----------
W. SO. CEN.		
Arkansas	7	25
Louisiana	1	29
Oklahoma	2	0
Texas [3]	195	119
MOUNTAIN		
Montana	3	5
Idaho	0	2
Wyoming	4	0
Colorado	11	72
New Mexico	19	13
Arizona	44	47
Utah [2]	217	41
PACIFIC		
Washington	32	12
Oregon	56	14
California [3]	246	164
Total	3,443	4,232
10 weeks	28,701	42,416

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever week ended Mar. 9, 1940, 19 cases as follows: North Carolina, 1; South Carolina, 7; Georgia, 1; Florida, 2; Alabama, 3; Mississippi, 1; Texas 3; California, 1.
[4] Later information reduces to 3 and 2, respectively, the reported numbers of typhoid fever cases in Florida and Pennsylvania for the weeks ended Feb. 10 and 17, Public Health Reports, Feb. 16 and 23, 1940, pp. 296 and 336.

WEEKLY REPORTS FROM CITIES

City reports for week ended Feb. 24, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	173	996	147	6, 263	976	2, 209	33	400	20	1, 162	--------
Current week [1]	83	666	104	1, 220	708	1, 591	0	333	9	662	--------
Maine:											
Portland	0	------	0	17	1	2	0	0	0	0	18
New Hampshire:											
Concord	------	------	------	------	------	------	------	------	------	------	------
Manchester	0	------	0	2	0	2	0	0	0	0	14
Nashua	0	------	0	8	0	0	0	0	0	0	5
Vermont:											
Barre	0	------	------	0	------	0	0	------	0	0	------
Burlington	0	------	0	0	0	0	0	0	0	0	7
Rutland	0	------	0	0	0	0	0	0	0	0	5
Massachusetts:											
Boston	1	------	1	17	21	24	0	9	0	33	269
Fall River	0	------	0	13	2	2	0	0	0	20	25
Springfield	0	------	0	0	0	13	0	1	0	2	34
Worcester	0	------	0	4	15	3	0	2	0	3	65
Rhode Island:											
Pawtucket	0	------	0	0	0	2	0	0	0	6	23
Providence	0	------	1	86	7	7	0	3	0	1	76
Connecticut:											
Bridgeport	0	------	0	0	2	5	0	1	0	0	29
Hartford	0	------	0	0	3	4	0	2	4	2	49
New Haven	0	1	1	0	2	2	0	0	0	1	48
New York:											
Buffalo	0	------	0	1	13	20	0	6	0	2	155
New York	21	44	7	48	116	412	0	63	0	65	1, 575
Rochester	0	1	0	1	2	10	0	0	0	2	80
Syracuse	0	------	0	0	2	8	0	1	0	18	57
New Jersey:											
Camden	1	1	1	0	4	11	0	1	0	0	26
Newark	0	6	1	31	5	15	0	0	0	10	110
Trenton	0	------	0	0	2	6	0	2	0	0	35
Pennsylvania:											
Philadelphia	1	9	5	6	23	84	0	22	0	50	543
Pittsburgh	3	8	7	1	26	40	0	7	0	10	203
Reading	0	------	1	0	7	0	0	0	0	8	46
Scranton	1	------	0	1	0	2	0	0	0	0	1
Ohio:											
Cincinnati	3	1	3	0	13	7	0	6	0	8	165
Cleveland	1	116	4	0	20	39	0	5	0	17	191
Columbus	1	5	5	0	5	3	0	0	0	3	81
Toledo	0	------	0	1	6	15	0	3	0	7	60
Indiana:											
Anderson	0	------	0	0	2	3	0	0	0	3	10
Fort Wayne	0	------	0	0	1	0	0	1	0	2	24
Indianapolis	1	------	1	1	15	21	0	2	0	7	147
Muncie	0	------	1	0	0	3	0	1	0	0	14
South Bend	0	------	0	0	2	0	0	0	0	0	18
Terre Haute	0	------	1	0	2	0	0	0	0	0	19
Illinois:											
Alton	0	------	0	0	0	1	0	0	0	1	8
Chicago	10	26	4	20	44	408	0	41	0	24	801
Elgin	0	------	0	0	2	2	0	0	0	5	10
Moline	0	------	0	0	0	2	0	0	0	0	6
Springfield	0	------	0	1	4	4	0	0	0	1	29
Michigan:											
Detroit	2	2	2	12	12	85	0	13	0	29	266
Flint	0	------	0	1	5	12	0	1	0	15	30
Grand Rapids	0	------	1	3	1	26	0	0	0	4	44
Wisconsin:											
Kenosha	0	1	0	0	0	0	0	0	0	2	8
Madison	0	------	------	0	------	3	0	------	0	10	------
Milwaukee	0	------	0	13	8	31	0	1	0	7	103
Racine	0	------	0	3	0	2	0	0	0	1	10
Superior	0	------	0	9	0	0	0	0	0	0	7

[1] Figures for Concord, Boise, and Tacoma estimated; reports not received.

City reports for week ended Feb. 24, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	212	0	1	0	2	0	1	30
Minneapolis	0	------	0	2	8	21	0	1	0	3	126
St. Paul	0	------	0	3	0	16	0	0	0	5	72
Iowa:											
Cedar Rapids	0	------	------	8	------	1	0	------	0	0	------
Davenport	1	------	------	0	------	1	0	------	0	0	------
Des Moines	0	------	0	3	0	16	0	0	0	0	33
Sioux City	0	------	------	1	------	5	1	------	0	0	------
Waterloo	1	------	------	1	------	0	0	------	0	0	------
Missouri:											
Kansas City	0	7	4	3	15	15	0	5	0	0	131
St. Joseph	1	------	2	1	7	2	0	0	0	0	27
St. Louis	2	8	1	0	27	22	0	11	0	5	246
North Dakota:											
Fargo	0	------	0	0	2	0	0	0	0	0	5
Grand Forks	0	------	------	0	------	0	1	------	0	4	------
Minot	0	------	0	1	0	1	0	0	0	0	7
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	0	------
Sioux Falls	0	------	0	0	0	0	0	0	0	0	9
Nebraska:											
Lincoln	0	------	------	1	------	3	0	------	0	0	------
Omaha	0	------	0	3	6	5	0	1	0	0	62
Kansas:											
Lawrence	0	10	0	0	0	0	0	0	0	0	4
Topeka	0	------	0	1	3	2	0	0	0	0	11
Wichita	2	2	0	232	5	4	0	0	0	1	41
Delaware:											
Wilmington	0	------	0	0	4	3	0	1	0	1	26
Maryland:											
Baltimore	0	27	3	2	24	11	0	12	0	138	247
Cumberland	0	------	0	0	2	1	0	0	0	0	22
Frederick	0	------	0	0	2	0	0	0	0	0	6
District of Columbia:											
Washington	5	8	2	2	15	25	0	10	0	24	165
Virginia:											
Lynchburg	1	------	0	0	5	2	0	0	0	2	21
Richmond	1	------	6	2	8	4	0	2	0	3	77
Roanoke	0	------	0	1	0	2	0	0	0	0	16
West Virginia:											
Charleston	0	2	1	0	3	1	0	1	0	0	14
Huntington	0	------	------	0	------	1	0	------	0	0	------
Wheeling	0	------	0	0	1	2	0	2	0	1	23
North Carolina:											
Gastonia	0	1	------	2	------	1	0	------	0	0	------
Raleigh	0	------	0	1	1	0	0	0	0	0	16
Wilmington	0	------	0	0	2	0	0	0	0	0	9
Winston-Salem	0	------	0	1	1	2	0	0	0	0	17
South Carolina:											
Charleston	0	70	0	0	1	1	0	0	0	0	22
Florence	0	12	0	0	1	0	0	0	1	0	8
Greenville	1	------	0	0	2	0	0	0	0	0	14
Georgia:											
Atlanta	0	26	1	27	12	1	0	7	0	1	91
Brunswick	0	------	0	4	0	0	0	0	0	0	2
Savannah	0	22	0	0	1	0	0	1	1	0	29
Florida:											
Miami	0	3	2	0	4	0	0	2	1	0	58
Tampa	3	------	0	33	3	1	0	1	0	0	31
Kentucky:											
Ashland	1	------	0	1	0	0	0	0	0	0	6
Covington	0	1	0	1	2	4	0	3	0	2	15
Lexington	1	------	0	1	2	0	0	2	0	1	17
Louisville	0	43	1	1	12	22	0	1	0	23	87
Tennessee:											
Knoxville	0	17	0	0	0	10	0	0	1	0	21
Memphis	0	63	12	12	9	24	0	3	0	8	110
Nashville	0	------	4	11	6	1	0	6	0	2	61
Alabama:											
Birmingham	1	8	0	2	6	2	0	0	0	1	66
Mobile	1	9	2	0	2	2	0	1	0	0	32
Montgomery	0	1	------	6	------	2	0	------	0	1	------

City reports for week ended Feb. 24, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	21	------	0	------	2	0	------	0	0	------
Little Rock	0	30	1	0	6	0	0	3	0	0	------
Louisiana:											
Lake Charles	0	------	0	0	1	0	0	0	1	0	8
New Orleans	3	23	4	2	29	5	0	10	1	22	230
Shreveport	0	------	2	1	7	1	0	1	0	0	40
Oklahoma:											
Oklahoma City	0	12	0	2	12	1	0	1	0	0	35
Tulsa	0	------	------	0	------	5	0	------	0	14	------
Texas:											
Dallas	4	6	0	3	5	5	0	5	0	6	78
Fort Worth	0	------	0	0	11	3	0	0	1	14	45
Galveston	0	------	0	2	4	1	0	2	0	0	25
Houston	0	10	0	3	15	6	0	7	0	2	109
San Antonio	0	25	7	53	19	2	0	7	1	1	95
Montana:											
Billings	1	------	0	1	1	0	0	0	0	0	11
Great Falls	0	------	0	0	2	0	0	0	1	0	8
Helena	0	------	0	0	0	1	0	0	0	0	8
Missoula	0	4	0	0	1	1	0	0	0	1	9
Idaho:											
Boise	------	------	------	------	------	------	------	------	------	------	------
Colorado:											
Colorado Springs	0	------	0	0	1	3	0	2	0	0	16
Denver	5	------	1	5	13	4	0	3	0	1	94
Pueblo	0	------	------	1	2	6	0	0	0	3	5
New Mexico:											
Albuquerque	0	------	0	0	1	1	0	0	0	0	6
Utah:											
Salt Lake City	0	------	0	55	3	4	0	2	0	38	35
Washington:											
Seattle	0	------	3	152	2	10	0	5	0	11	82
Spokane	0	------	0	1	2	5	0	1	0	0	36
Tacoma	------	------	------	------	------	------	------	------	------	------	------
Oregon											
Portland	1	5	0	133	4	3	0	3	1	19	87
Salem	0	------	------	13	------	2	0	------	0	0	------
California:											
Los Angeles	1	90	2	11	7	38	0	8	0	18	288
Sacramento	3	5	0	0	4	1	0	4	0	4	29
San Francisco	4	------	0	1	5	17	0	17	1	12	190

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				Iowa:			
Boston	0	0	1	Des Moines	1	1	0
New York:				Kansas:			
New York	1	0	1	Wichita	0	1	0
New Jersey:				South Carolina:			
Newark	1	0	0	Florence	0	1	0
Pennsylvania:				Kentucky:			
Pittsburgh	1	0	0	Lexington	1	0	0
Scranton	1	1	0	Louisville	1	1	0
Illinois:				Texas:			
Chicago	2	1	0	Dallas	1	0	0
Minnesota:				California:			
Minneapolis	1	0	0	Los Angeles	1	0	1
St. Paul	0	1	0				

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Pittsburgh, 1; Cleveland, 1; Wichita, 3.

Pellagra.—Cases: Lynchburg, 1; Charleston, S. C., 1; Atlanta, 1; Little Rock, 2; New Orleans, 2; Dallas, 1; Los Angeles, 2.

Rabies in man.—Deaths: Cincinnati, 1.

Typhus fever.—Cases: New Orleans, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 30, 1939.—During the week ended December 30, 1939, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1		2						3
Chickenpox		4	3	65	358	82	58	16	30	616
Diphtheria			2	24	2	10		3		41
Influenza		59			42				18	119
Measles		1	4	151	295	41	6	15	10	523
Mumps			2	8	98	4	18	5	6	141
Pneumonia		16			25		1		5	47
Poliomyelitis					1					1
Scarlet fever	1	5	10	142	165	22	15	30	6	396
Tuberculosis	1	6	3	13	32	4	11			70
Typhoid and paratyphoid fever				9	1	6		4	1	21
Whooping cough		7	1	40	62	45	16	7	6	184

FINLAND

Communicable diseases—December 1939.—During the month of December 1939, cases of certain communicable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	223	Poliomyelitis	2
Influenza	1,731	Scarlet fever	357
Paratyphoid fever	155	Typhoid fever	16

ITALY

Communicable diseases—4 weeks ended December 3, 1939.—During the 4 weeks ended December 3, 1939, cases of certain communicable diseases were reported in Italy as follows:

Disease	Nov. 6-12	Nov. 13-19	Nov. 20-26	Nov. 27-Dec. 3
Anthrax	24	18	10	14
Cerebrospinal meningitis	18	17	20	18
Chickenpox	152	230	196	282
Diphtheria	921	899	836	839
Dysentery (amoebic)	13	16	21	16
Dysentery (bacillary)	3	15	6	7
Hookworm disease	10	8	36	34
Lethargic encephalitis	1		2	1
Measles	629	644	693	792
Mumps	141	165	153	146
Paratyphoid fever	105	101	91	73
Pellagra				1
Poliomyelitis	100	70	51	45
Puerperal septicemia	25	27	31	24
Scarlet fever	304	314	322	301
Typhoid fever	734	611	540	522
Undulant fever	49	41	42	30
Whooping cough	277	203	200	294

YUGOSLAVIA

Communicable diseases—4 weeks ended January 28, 1940.—During the 4 weeks ended January 28, 1940, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	10	1	Poliomyelitis	8	1
Cerebrospinal meningitis	110	27	Scarlet fever	237	2
Diphtheria and croup	605	70	Sepsis	6	
Dysentery	7	1	Tetanus	13	4
Erysipelas	192	7	Typhoid fever	298	42
Favus	4		Typhus fever	60	5
Paratyphoid fever	6				

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of February 23, 1940, pages 342-345. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

Indochina (French)—Vientiane.—During the week ended February 17, 1940, 1 fatal case of cholera was reported in Vientiane, French Indochina.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Kukaiau (vicinity of).—One rat found on February 1, and another rat found on February 7, 1940, in the vicinity of Kukaiau, Hamakua District, Island of Hawaii, T. H., were proved positive for plague.

Indochina (French)—Pnom-Penh.—During the week ended February 24, 1940, 1 fatal case of plague was reported in Pnom-Penh, French Indochina.

Peru.—During the month of December 1939, plague was reported in Peru, by Departments, as follows: Ancash, 1 case; Cajamarca, 1 case, 1 death; Lambayeque, 4 cases, 3 deaths; Libertad, 10 cases, 5 deaths; Lima, 12 cases, 5 deaths; Piura, 5 cases, 1 death.

Typhus Fever

Mexico.—During the month of November 1939, typhus fever was reported in Mexico as follows: Aguascalientes, Aguascalientes State, 1 case; Mexico, D. F., 10 cases, 5 deaths; Queretaro, Queretaro State, 1 case, 1 death; Saltillo, Coahuila State, 2 cases; San Luis Potosi, San Luis Potosi State, 2 cases, 3 deaths.

Venezuela—Valencia.—During the period January 15–31, 1940, 1 case of typhus fever was reported in Valencia, Venezuela.

Yellow Fever

Brazil—Espirito Santo State.—During the period January 26–30, 1940, deaths from yellow fever (jungle type) were reported in Espirito Santo State, Brazil, as follows: Cachoeiro Itapemirim, 2; Itapemirim, 1; Joao Neiva, 1; Santa Leopoldina, 1.

Colombia.—Yellow fever has been reported in Colombia as follows: Antioquia Department, February 3, 1 death: Caldas Department, February 17, 1 death.

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Public Health Reports

VOLUME 55 — MARCH 22, 1940 — NUMBER 12

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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USING TESTS AS A MEDIUM FOR HEALTH EDUCATION [1]

By Mayhew Derryberry, *Senior Public Health Statistician*, and Arthur Weissman, *United States Public Health Service*

Health educators are constantly on the lookout for new and effective educational devices to use for disseminating scientific information on the prevention of disease and improvement of the health of the general public. They realize that as educators they succeed or fail in proportion to their ability to reach a large audience and stimulate it to an active interest in the subject matter. They further recognize variety in presentation as an important factor in attracting the attention and arousing the interest of the public. Since health educators need a number of techniques, this paper describes a new method developed as a byproduct of a research study [2] carried on cooperatively by the American Museum of Health and the United States Public Health Service in the Medicine and Public Health Building at the New York World's Fair, 1939.

One of the objectives of the study was to determine the extent of health information possessed by adult visitors to the fair. For this purpose data were collected at an exhibit booth (called "The Quiz Corner") in the Medicine and Public Health Building at which visitors were invited to take an objective health-information test. During the course of the Fair seven forms of tests containing in all 225 questions were given. The tests covered the following subjects: (*a*) Prevention and treatment of communicable and chronic diseases; (*b*) prevention and treatment of common minor ailments; (*c*) nutrition; (*d*) health superstitions; (*e*) patent medicines; and (*f*) vital statistics. The questions were of either the true-false or multiple-choice type and the visitor was asked to underline the correct answer in the space provided.[3]

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[1] From the Division of Public Health Methods, National Institute of Health.

[2] The Visitor Reaction Study was undertaken as a means of obtaining objective data as a guide to the future planning of exhibits. It was supported by a grant from the Carnegie Corporation of New York. A detailed description of the Study will be given in the complete report which is now in preparation.

[3] For true-false questions, the instructions were, "Read each of the following statements. If you think a statement is true, blacken the space marked 'T' on the line on the answer sheet numbered the same as the statement; if you think the statement is false, blacken the space marked 'F.'"

For multiple-choice questions, the instructions were "In each question underline one answer which you think is best."

The following are typical questions constructed on the above subjects:

1. A child will not contract syphilis from a syphilitic mother if she has been given adequate treatment during her pregnancy ------------ T F
2. Athlete's foot is a very common ailment which is highly contagious (catching) ------------ T F
3. Feed a cold and starve a fever is a good rule to follow when one has a cold or fever ------------ T F
4. Halitosis (bad breath) cannot be cured by mouth washes ------------ T F
5. Surgery, radium, and X-rays are the three most effective methods of treating cancer ------------ T F
6. Pellagra is caused by—
   unsanitary living conditions | eating no red meat or green vegetables | an unknown germ | eating too much rich food
7. The disease with the highest death rates in infancy and in old age is—
   pneumonia | tuberculosis | heart disease
8. A lump in any part of the body which begins to grow should be—
   examined by a doctor | let alone unless it becomes painful | treated with a salve and bandaged
9. Habitual constipation is frequently corrected by—
   taking cathartics | taking enemas habitually | proper diet
10. The most important single item in the treatment of tuberculosis is—
   medicine | diet | rest

The response of the public to the invitation to take these tests was most gratifying. Motivated by curiosity, competition, or the opportunity for participation 35,000 individuals took some form of the seven tests. Frequently "The Quiz Corner" was unable to accommodate the large number of persons wishing to be tested.

Each test form, after being marked by the visitor, was placed in a test-scoring machine provided through the courtesy of the International Business Machines Corporation. By pressing a button the operator could read the number of correct answers on a dial and give the visitor a numerical score, such as "39 correct out of 50 questions," or "16 correct out of 25."

Although this method of giving and scoring tests served the purposes of the study in that it provided a large number of responses to behavioral health questions from a heterogeneous sample of the general public,[4] it did not satisfy those who had taken the tests. They wanted to know more than numerical scores. Not only did they want all the correct answers, but frequently they insisted on finding out which of their answers was wrong and why. This demand for answers suggested educational possibilities in the technique. Accordingly, it was decided to prepare a set of answers for one of the tests and determine experimentally its usefulness.

The answers as prepared not only gave the correct response to each question, but also attempted to explain the answer and give some of

[4] Test results by age, sex, and residence of visitors will be given in subsequent papers.

its implications for individual health behavior. For example, the multiple-choice statement, "The most important single item in the treatment of tuberculosis is (a) medicine, (b) diet, (c) rest" was not considered "answered" by stating simply that rest is the most important single factor in tuberculosis therapy. From the standpoint of health education, such didactic information would be of little significance to the individual who took the test, unless there were also an adequate explanation of *why* "rest" is the correct choice. Even so, the visitor, it was felt, would soon forget an answer limited to spot information devoid of contextual meaning. Therefore, the following paragraph was given as the answer to the question.[5]

When tuberculosis germs enter the body, nature rushes to prevent the spread of the organisms. The germ has a waxy, protective coating which our body defenses cannot break down. Instead, the body tries to build a wall of hard, protective tissue around the germ so as to block it off. To build protective tissue, the body's first requirement is *rest*, just as an injured member must be put at complete rest when a bone is broken. Since breathing itself is strenuous exercise for a sick lung, *rest in bed is the most important step toward recovery* in tuberculosis of the lungs. When we are resting in bed, we breathe less deeply and less rapidly than when we are up and about. The lungs get more rest. To help the body carry on the healing process, a good nourishing *diet* is also needed. (So far, science has not discovered any medicine that will cure tuberculosis.) Doctors give medicines to tuberculous patients only to strengthen recuperative powers or relieve distressing symptoms. Patients should take medicine only under a doctor's orders. No patent medicines will cure tuberculosis. Many patent medicines contain drugs that are actually harmful to the tuberculous patient.

When answers had been prepared for one of the tests, they were mimeographed and each participant was given a set of answers after his test was scored.[6] Careful observation of the behavior of persons receiving the forms revealed that the answers were kept and read and not thrown away. As a result of this successful experiment, sets of answers were prepared for the remaining six test forms. These sets have been and are being mailed to the persons who took the tests and requested the answer sheets.

Since the method described has proved effective in a research situation focused on testing the public's information rather than on stimulating interest in health education, its usefulness could be improved by rephrasing questions to serve the latter objective. Furthermore, if tests are intended for educational rather than research purposes, the questions used need not be such as have only one unequivocally correct answer. Tests could be constructed containing statements which

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[5] The Study gratefully acknowledges the assistance of Miss Mary Connolly, Director, Division of Health Education, Detroit Department of Health; Dr. Norman R. Goldsmith; and The Information Service, Division of Sanitary Reports and Statistics of the U. S. Public Health Service in preparing the paragraphs of information for the 225 questions used. The Study is also grateful to the New York World's Fair for duplicating the answers that had been prepared.

[6] The effect of this procedure on the research results was carefully checked. The visitors' scores were not materially higher on days when answers were given out than on other days.

are true, partly true, or false, depending on the factual situation to which they are applied. For example, the statement, "A successful vaccination produces immunity to smallpox" could be used even though its truth or falsity is a function of the additional factors of time and repetition of vaccination. Test questions might well be based upon statements about which there is widespread disagreement among health educators. For example, inclusion of such a highly debatable statement as, "If an expectant mother drinks alcohol her child will have poor health" would permit the answers to contain a discussion of the existing research information on the known effects of drinking alcohol even though science has not definitely proved the truth or falsity of the statement. Hence, in other than research situations, the procedure is quite flexible and can be adapted to many varieties of subject matter.

As a means of health education, the technique of testing and providing answers to test questions may be used in any exhibit situation in which the number of visitors is large enough to warrant having an attendant at a quiz booth. Elaborate designing and artistic construction of the booth are completely unnecessary, and the cost of tests and answer forms is relatively low. One health officer has already announced a plan to use the technique as part of a public-health exhibit in a State fair in 1940.

The test-answer technique has a number of features which tend to ensure its success.

(1) It utilizes the present very widespread interest in test situations. Significant evidence of this interest may be found in the former popularity of "Ask-Me-Another" publications and, more recently, of radio quiz programs, currently rated as appealing to the largest audiences on the air.

(2) The competition present in a test situation is a powerful incentive toward taking tests and reading the answers to compare results. Groups of individuals approach a test competitively; each person strives to show superiority over others in the group. A person, not part of a group, frequently competes against the unknown; tries to get the highest score or, if less confident, tries to exceed the average score.

(3) The test-answer technique permits active public participation in an interesting form of health education. It arouses curiosity which accelerates learning. There is only a slight difference of form between a pamphlet of information and a set of answers covering the same subject matter; but the latter is a much more effective educational instrument. Interest in the informational aspect of the test is stimulated by answering or attempting to answer the questions. An individual may pay little, if any, attention to a conventional presentation of factual material on cancer, syphilis, tuberculosis, nutrition,

or preventive health services, for example, but he is interested in the answers to a test he has taken. Furthermore, he is chiefly concerned with the answers he did not know or the answers about which he had some doubt. The motivation for learning is therefore directed to the subject matter in which learning is necessary.

SUMMARY

A technique for educating the public in health by means of testing and providing answers to test questions was developed as a byproduct of a study conducted cooperatively by the American Museum of Health and the Public Health Service at the Medicine and Public Health Building at the New York World's Fair. It is suggested as an effective, simple, and inexpensive procedure applicable to other mass health education situations.

SIPHONAPTERA: NOTES ON TWO CALIFORNIA SPECIES[1]

By Wm. L. Jellison, *Assistant Parasitologist, United States Public Health Service*

Carteretta carteri Fox 1927 was described from a single male and *Monopsyllus fornacis* Jordan 1937 was described from 2 females. A large series of fleas from the Hastings Natural History Reservation in Monterey County, Calif., received recently through the courtesy of Dr. J. M. Linsdale, Director of the Reservation, contained specimens of both sexes of these species.

Carteretta carteri Fox[2]

The male flea from which this species was described was collected on a wood rat, *Neotoma fuscipes*, at Los Angeles, Calif., in 1925.

Female.—The head is shown in figure 1. Characteristic of this genus is the genal ctenidia of 3 heavy spines of which the second nearly covers the first. Eyes well pigmented in both sexes in contrast to description by Fox. Antennal groove continuous across the dorsum of the head. Labial palpi 5-jointed, extending about two-thirds the length of anterior coxae. Pronotal ctenidia of about 16 spines. Fine bristles on lower two-thirds of inner coxal surface near the anterior edge. Five plantar bristles on all tarsi, first pair placed between second pair. Apical spinelets on tergites 1 to 5. Antepygidial bristles 3 on each side, inner one shortest. Length of style about 4 times its basal width, tapering, with single long terminal bristle. Three stout, straight, spine-like bristles near ventral angle of anal sternite. Sternite 7 is shown in figure 1. It bears no sinus, sclerifica-

[1] From the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

[2] Transactions of the American Entomological Society, 53: 209-210 (1927).

tion, or prominent lobe on the posterior margin. Receptaculum seminis is figured.

Allotype female from *Peromyscus maniculatus*, Hastings Natural History Reservation, Monterey County, Calif., November 28, 1938, was deposited in the collection of the Rocky Mountain Laboratory.

The modified abdominal segments of the male were described by Fox but not illustrated. The clasper and sternite 9 are therefore figured (fig. 1).

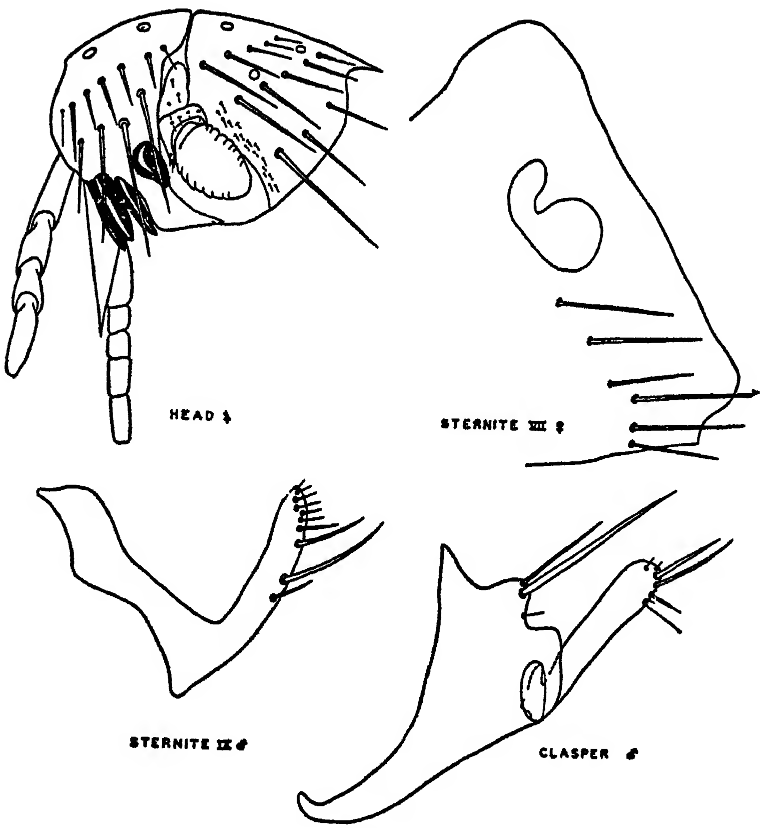

FIGURE 1.—*Carteretta carteri.*

The collection from the Hastings Reservation, received from Dr. J. M. Linsdale, contained the following specimens: Two males and 1 female (allotype) from *Peromyscus maniculatus*, 2 hosts, December 1938, November 1939; 1 male from *Peromyscus truei*, 1 host, January 1939; and 7 males, 10 females from *Perognathus californicus*, 9 hosts, October, November, and December 1938, April 1939.

Monopsyllus fornacis Jordan [3]

Two females collected on *Sciurus griseus*, Seven Oaks, San Bernardino County, Calif., formed the type series of this species. The holotype female is deposited at the Rocky Mountain Laboratory.

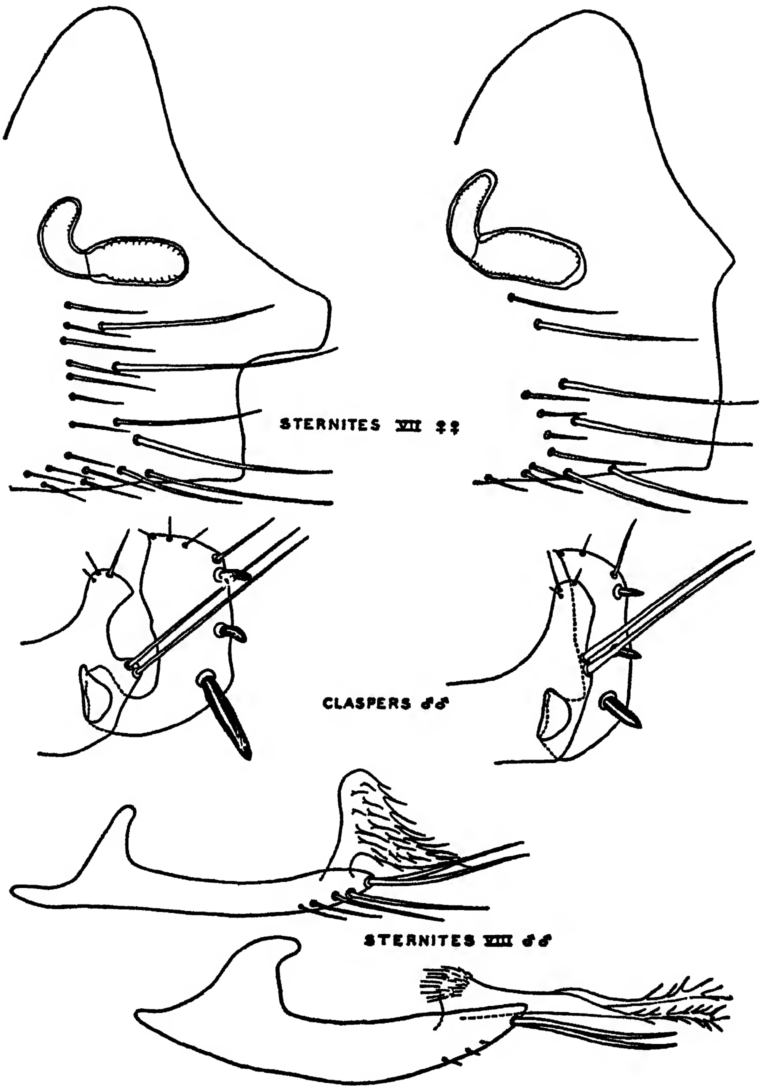

FIGURE 2.—*Monopsyllus eumolpi* (left). *Monopsyllus fornacis* (right).

Male.—The male, like the female, shows very close relationship to *M. eumolpi* (Rothschild) 1905, but the differences are considered

[3] Novitates Zoologicae, 40: 263 (1937), text figure 45.

sufficient to warrant its retention as a valid species, especially when compared with specimens of *M. eumolpi* from California. In males of both species the first segment of the mid tarsus is elongate and bears on its posterior side a very characteristic fringe of long thin bristles. *M. fornacis* differs from *M. eumolpi* mainly in the modified abdominal segments which are figured for both species (fig. 2). In *M. fornacis* the immovable process of the clasper is longer and broader. The movable process is narrower. The spines on the latter are shorter, heavier, and straight, in contrast to slightly curved spines in *M. eumolpi*. Sternite 8 is broader, shorter, and has fewer ventral bristles. It bears a pair of posteriorly projecting filamentous plumes.

The seventh sternite of the female is also refigured for *M. fornacis* and *M. eumolpi* (fig. 2).

Allotype male from *Eutamias merriami*, Hastings Natural History Reservation, Monterey County, Calif., July 18, 1939, was deposited in the collection of the Rocky Mountain Laboratory. The collection from Hastings Reservation also contained 5 males and 24 females collected in April, June, and July 1939 from 12 chipmunks, *E. merriami*, which appeared to be the normal hosts.

SPECIMENS FIGURED

Carteretta carteri, male from *Peromyscus truei*, female (allotype) from *Peromyscus maniculatus*, Hastings Natural History Reservation, Monterey County, Calif.

Monopsyllus eumolpi, male and female from *Eutamias* sp., Alpine County, Calif.

Monopsyllus fornacis, male (allotype) and female from *Eutamias merriami*, Hastings Natural History Reservation, Monterey County, Calif.

ORNITHODORUS HERMSI: FEEDING AND MOLTING HABITS IN RELATION TO THE ACQUISITION AND TRANSMISSION OF RELAPSING FEVER SPIROCHETES [1]

By GORDON E. DAVIS, *Bacteriologist*, and MARY E WALKER, *Laboratory Assistant, United States Public Health Service*

Two species of *Ornithodorus* with which we have worked extensively, viz, *O. turicata* and *O. parkeri*, feed only once between molts. However, we have found that during the winter months the immature stages of *O. hermsi* may feed several times without molting and that incident to these multiple intermolting feedings this tick may acquire and transmit spirochetes.

[1] From the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

In January 1937, 30 *O. hermsi* first stage nymphs engorged on a normal white rat. The nymphs failed to molt within the usual period and were given further opportunities to feed. Ten died without molting or further feeding. Of the remaining 20, 16 engorged from 2 to 4 times before molting. Seven engorged from 2 to 3 times in the second nymphal stage, and 4 engorged from 2 to 3 times in the third stage. These findings suggested a study of spirochete transmission in conjunction with this multiple feeding habit between molts

In June 1938, two series of observations were started, one by the junior author (experiment 1) in the Hamilton, Mont., laboratory and the other by the senior author (experiment 2) in a temporary laboratory at Laramie, Wyo. The Hamilton laboratory is located at an elevation of approximately 3,500 feet and the Wyoming laboratory at about 7,000 feet. The latter is well within the usual elevation range of *O. hermsi.*

Immediately after feeding all larvae were placed in individual shell vials, numbered serially, and stored in humidity jars at room temperature. Daily observations were made for molts.

EXPERIMENT 1 (FIGURE 1)

On June 22 and 24, 1938, 45 larvae engorged on a white rat infected with a *hermsi* strain of spirochetes. Eighteen died at the time of molting. Of the remaining 27, 23, as first nymphs, were allowed to feed again on a white rat infected with the same strain. Only 20 ticks, 13 females and 7 males, survived to the adult stage.

Multiple feeding between molts began in October when the ticks were in the second and third nymphal stages. In the second stage, 3 engorged 3 times and one 4 times. The remaining 15 fed only once as second stage nymphs but each engorged 3 times in the third stage. These feeding periods covered the months of October, November, and December, and ended in January. The ticks were then placed in a room at a daytime temperature of approximately 80° F. Molting, at this temperature, began in late January and February.

Transmission.—Thirteen (65 percent) of the 20 ticks that survived to the adult stage transmitted spirochetes 1 or more times, while 7 (35 percent) failed in transmission. Of the 13 females, 61 percent were positive, and of the 7 males, 71 percent. Six (46 percent) of the "positive" ticks transmitted spirochetes one or more times during the multiple feeding period.

EXPERIMENT 2 (FIGURES 2 AND 3)

One hundred and six larvae from 3 successive lots of eggs deposited (June, July, and August) by the same female were used. Thirty-eight died at the larval or first nymphal molt and 3 additional deaths

TICK NO.	1	T	4	T	5	T	6	T	7	T	10	T	11	T	12	T	14	T	16	T
LARVAL FEEDING	6-22-38 C		6-22-38C		6-22-38C		6-22-38C		6-22-38C		6-22-38C		6-22-38C		6-22-38C		6-22-38C		6-22-38C	
MOLT	24		26		20		22		21		20		20		21		26		22	
1ST NYMPHAL FEEDING	7-19-38C		7-21-38C		7-19-38C		7-25-38C		7-19-38C		7-19-38C	.	7-21-38C		7-19-38C		7-25-38C		7-19-38C	
MOLT	14		16		13		14		11		20		13		15		27		16	
2ND NYMPHAL FEEDING	8-11-38	+	8-12-38	−	8-12-38	−	8-15-38	+	8-11-38	−	8-12-38	+	8-13-38	−	8-12-38	+	9-29-38 11-16-38 1-11-39	− − −	8-12-38	+
MOLT	18		15		17		17		18		20		16		17		27		19	
3RD NYMPHAL FEEDING	9-27-38 11-9-38 12-29-38	+ + −	9-26-38 11-12-38 12-30-38	+ + −	9-29-38 11-16-38 1-11-39	− − −	9-29-38 11-16-38 1-5-39	+ + −	9-29-38 11-16-38 1-11-39	− − −	9-29-38 11-9-38 1-6-39	+ − −	9-29-38	−	9-29-38 11-16-38 12-20-38	+ − −	2-10-39	−	9-29-38 11-12-38 12-16-38	+ + +
MOLT	28♀		26♂		27♀		24♀		29♀		24♀		34♀		37♂		24♀		38♂	
4TH NYMPHAL FEEDING																				
MOLT																				
ADULT FEEDING	2-2-39	+	2-2-39	+	2-10-39	−	2-2-39	+	2-15-39	[illegible]	2-3-39	+	11-30-38	−	2-10-39	−	3-8-39	+	1-25-39 2-15-39	+ +

C = ENGORGED ON WHITE RATS INFECTED WITH CALIFORNIA (HERMSI) STRAIN OF SPIROCHETES.
T = TRANSMISSION
NUMBERS IN MOLT (HORIZONTAL) COLUMN = NUMBER OF DAYS AFTER LAST FEEDING.
♂ OR ♀ INDICATE THE SEX OF THE TICK FOLLOWING THIS MOLT.

FIGURE 1.—Infective blood meals in larval and first nymphal stages, multiple feedings in second and third nymphal stages.

TICK NO.	18	T	19	T	20	T	21	T	22	T	23	T	25	T	26	T	29	T	30	T
LARVAL FEEDING	6-22-38C		6-22-38C		6-22-38C		6-22-38C		6-22-38C		6-22-38C		8-24-38C		8-24-38C		8-24-38C		8-24-38C	
MOLT	20		22		21		21		25		26		29		19		29		24	
1ST NYMPHAL FEEDING	7-19-38C		7-25-38C		7-28-38C		7-19-38C		7-19-38C		7-25-38	−	8-12-38	+	7-19-38C		8-12-38	+	8-15-38	−
MOLT	17		16		16		11		15		13		14		11		14		17	
2ND NYMPHAL FEEDING	8-12-38	+	8-15-38	−	8-15-38	−	8-12-38	−	8-12-38	−	8-15-38	−	9-26-38 11-16-38 12-30-38 1-28-39	− − − −	8-11-38	−	9-26-38 10-16-38 1-6-39	+ − −	9-29-38 11-16-38 1-12-39	− − −
MOLT	17		18		17		19		19		18		21 ♀		18		22		22	
3RD NYMPHAL FEEDING	9-29-38 11-9-38 12-30-38	+ − +	9-29-38 11-16-38 12-30-38	+ + −	9-29-38 11-12-38 1-5-39	+ − −	9-28-38 11-16-38 1-11-39	− − −	9-6-38 11-16-38 1-11-39	− − −	9-29-38 11-16-38 1-11-39	− − −			9-29-38 10-16-38 1-12-39	− − −	2-1-39	−	2-10-39	−
MOLT	29 ♂		31 ♂		25 ♀		28 ♀		29 ♀		29 ♂				23 ♀		22 ♀		19 ♂	
4TH NYMPHAL FEEDING																				
MOLT																				
ADULT FEEDING	2-1-39	+	2-15-39	+	2-2-39	−	2-10-39	−	2-15-39	+	2-15-39	−	2-23-39	+	2-15-39	−	3-1-39	+	3-8-39	−

FIGURE 1.—Concluded. (See notes following first section of figure).

TICK NO.	2	T	3	T	5	T	6	T	7	T	8	T	10	T	11	T	12	T	14	T
LARVAL FEEDING	5-31-38	–	6-1-38	–	6-9-38	–	6-9-38	–	6-9-38	–	6-9-38	–	6-4-38	–	6-9-38	–	6-4-38	–	6-9-38	–
MOLT	18		21		14		14		14		14		14		15		15		15	
1ST NYMPHAL FEEDING	7-4-38C		7-27-38C		6-20-38C		7-6-38C		6-27-38C		7-12-38C		7-2-38C		7-16-38C		7-5-38C		7-5-38C	
MOLT	12		14		16		11		19		13		12		14		14		10	
2ND NYMPHAL FEEDING	7-19-38C		8-15-38C	–	7-16-38C		7-19-38C		7-16-38C		7-16-38C		7-16-38C		8-15-38	+	8-15-38	+	7-27-38C	
MOLT	20				25		28		20		21		22		17		17		13	
3RD NYMPHAL FEEDING	8-12-38	+	9-27-38 11-16-38 1-12-39	– – –	8-16-38	–	9-28-38 11-16-38 1-11-39	– + –	8-10-38	–	9-28-38 11-12-38 1-5-39	+ – +	8-12-38	+	9-28-38	+	9-29-38	+	8-16-38	–
MOLT	9 ♂		26		18 ♂		30 ♂		24 ♀		20 ♂		20 ♀		25		25		18 ♀	
4TH NYMPHAL FEEDING			2-10-39	–											11-12-38 1-5-39	– –	11-12-38 1-5-39	– –		
MOLT			24 ♀												20 ♂		20 ♂			
ADULT FEEDING	9-28-38 11-9-38 1-6-39	+ + +	3-8-39	–	9-27-38 10-21-38 11-16-38 1-11-39	– + + +	2-15-39	+	9-27-38 11-16-38 1-12-39	– – –	2-1-39	+	9-28-38 10-19-38 11-16-38 12-30-38	+ + + –	2-2-39	+	2-2-39	+	9-27-38	–

C = ENGORGED ON WHITE RATS INFECTED WITH CALIFORNIA (HERMSI) STRAIN OF SPIROCHETES

T = TRANSMISSION

NUMBERS IN MOLT (HORIZONTAL) COLUMN = NUMBER OF DAYS AFTER LAST FEEDING

♂ OR ♀ INDICATE THE SEX OF THE TICK FOLLOWING THIS MOLT.

FIGURE 2.—Infective blood meals in larval and first nymphal stages or in first and second nymphal stages, multiple feedings in third and fourth nymphal stages.

TICK NO.	18	T	22	T	23	T	24	T	25	T	26	T	27	T	28	T	29	T	30	T
LARVAL FEEDING	6-9-38	−	7-2-38C		7-2-38C		7-2-38C		7-2-38C		7-2-38C		7-2-38C		7-2-38C		7-2-38C		7-2-38C	
MOLT	17		13		18		13		12		13		18		13		11		13	
1ST NYMPHAL FEEDING	7-4-38C		7-17-38C		7-27-38C		7-19-38C		7-17-38C		7-17-38C		7-27-38C		7-19-38C		7-19-38C		7-17-38C	
MOLT	13		15		13		19		14		15		14		17		15		15	
2ND NYMPHAL FEEDING	7-19-38C		8-10-38		8-11-38	−	8-16-38	+	8-15-38	+	8-10-38	+	8-11-38	+	8-10-38	−	8-10-38	−	8-10-38	+
MOLT	21		19		16		16		19		17		21		16		19		19	
3RD NYMPHAL FEEDING	8-16-38	+	9-28-38 11-16-38 1-12-39	− − +	9-28-38 11-16-38 2-10-39	− − −	9-28-38 11-16-38 1-12-39	− − −	9-27-38 11-16-38	+ +	9-28-38 11-12-38 12-16-38	+ + +	9-28-38 11-16-38 1-6-39	+ − +	9-28-38 11-12-38 12-29-38	+ + +	9-28-38	−	9-28-38 11-12-38 1-5-39	+ − −
MOLT	21♂		23♀		30		23♀		27♀		41♂		22♂		31♀		30♀		24♂	
4TH NYMPHAL FEEDING					3-15-39															
MOLT					16♂															
ADULT FEEDING	9-27-38 11-16-38 1-5-39	+ − −	2-10-39	+	4-5-39	−	2-15-39	−	1-5-39	+	2-1-39	+	2-1-39	+	2-2-39	+	11-30-38	−	2-2-39	+

FIGURE 2.—Continued. (See notes following first section of figure.)

TICK NO.	31	T	33	T	36	T	38	T	43	T	48	T	50	T	51	T	52	T	53	T
LARVAL FEEDING	7-2-38C		7-2-38C		7-2-38C		7-2-38C		7-2-38C		7-4-38C		7-4-38C		7-4-38C		7-4-38C		7-4-38C	
MOLT	13		14		17		16		14		12		15		15		18		13	
1-ST NYMPHAL FEEDING	7-19-38C		7-19-38C		7-27-38C		7-19-38C		7-19-38C		7-27-38C		7-27-38C		7-27-38C		7-27-38C		7-27-38C	
MOLT	16		17		13		17		19		13		13		13		13		13	
2-ND NYMPHAL FEEDING	8-10-38	–	8-10-38	–	8-12-38	–	8-15-38	–	8-12-38	+	8-11-38	–	8-11-38	–	8-11-38	–	8-11-38	–	8-11-38	–
MOLT	24		17		17		17		17		18		20		18		16		21	
3-RD NYMPHAL FEEDING	9-27-38 10-21-38 11-16-38 1-6-39	– + – +	9-28-38 11-16-38 1-11-39	– – –	9-28-38 11-12-38 1-5-39	+ – –	9-28-38 11-16-38 1-5-39	+ + +	9-28-38 11-16-38 1-5-39	– + –	9-28-38	–	9-26-38 11-16-38 1-11-39	– – –	9-28-38 11-12-38 12-30-38	+ – –	9-28-38 11-16-38 1-11-39	– – –	9-28-38	–
MOLT	27 ♂		26 ♀		28 ♀		29 ♀		27 ♂		26 ♀		21 ♀		23 ♂		29 ♂		26	
4-TH NYMPHAL FEEDING																			11-30-38	–
MOLT																			30 ♂	
ADULT FEEDING	2-23-39	+	2-10-39	–	2-10-39	–	2-10-39	+	2-15-39	–	11-30-38	–	2-10-39	–	2-3-39	+	2-15-39	–	1-27-39	–

FIGURE 2.—Continued. (See notes following first section of figure.)

TICK NO.	54	T	55	T	57	T	58	T	59	T	60	T	61	T	68	T		
LARVAL FEEDING	7-4-38C		7-4-38C		7-4-38C		7-4-38C		7-4-38C		7-4-38C		7-4-38C		7-8-38C			
MOLT	13		19		15		15		15		15		15		14			
1ST NYMPHAL FEEDING	7-27-38C		7-27-38C		7-27-38C		7-27-38C		7-27-38C		7-27-38C		7-27-38C		7-27-38C			
MOLT	13		13		16		13		13		13		14		13			
2ND NYMPHAL FEEDING	8-11-38	—	8-15-38	+	8-15-38	—	8-11-38		8-15-38	+	8-17-38	—	8-16-38	—	8-11-38	—		
MOLT	21		19		19		23		22		20		18		20			
3RD NYMPHAL FEEDING	9-28-38 11-18-38 1-11-38	— — —	9-27-38 11-18-38 12-30-38	+ + —	9-27-38 11-9-38 12-29-38	+ — +	9-27-38 11-16-38 1-12-38	— — —	9-27-38 11-16-38 12-12-38	+ + +	9-27-38 11-9-38 12-30-38	+ — —	9-27-38 11-16-38 1-11-39	— — —	9-26-38 11-16-38 1-11-39	— — —		
MOLT	24♂		29♂		21♂		24♀		40♂		30♀		24♀		32♀			
4TH NYMPHAL FEEDING																		
MOLT																		
ADULT FEEDING	2-10-39	—	2-1-39	+	1-28-39	+	2-10-39	+	2-1-39	—	2-2-39	+	2-15-39	—	2-17-39	—		

FIGURE 2.—Concluded. (See notes following first section of figure.)

TICK NO.	69	T	70	T	71	T	72	T	75	T	76	T	77	T	78	T	80	T	81	T
LARVAL FEEDING	8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38	
MOLT	15		14		15		16		16		15		15		16		18		18	
1.ST NYMPHAL FEEDING	9-28-38	–	9-27-38	–	9-26-38	–	9-26-38	–	9-26-38	–	9-26-38	–	9-26-38	–	9-28-38 11-16-38	– –	9-26-38	–	9-26-38	–
MOLT	16		16		17		16		16		16		16		69		16		17	
2.ND NYMPHAL FEEDING	10-19-38 11-14-38C 12-30-38	– –	10-19-38 11-14-38C 12-30-38	– –	10-20-38 11-14-38C 12-30-38	– –	10-19-38 11-14-38C 12-30-38	– –	10-20-38 11-14-38C 12-29-38	– –	10-19-38 11-14-38C 12-22-38	– –	10-20-38 11-14-38C 12-35-38	– –	1-11-39	–	10-19-38 11-14-38C 12-16-38	– –	10-19-38 11-14-38C 12-30-38	– –
MOLT	23		25		23		25		28♂		33♂		23		22		37		27♀	
3.RD NYMPHAL FEEDING	1-25-39	–	2-3-39	+	1-25-39	–	1-26-39	–					1-25-39	–	2-2-39	–	1-25-39	–		
MOLT	21♀		20♀		21♀		21♂						25♀		22♂		23♀			
4.TH NYMPHAL FEEDING *																				
MOLT																				
ADULT FEEDING	2-23-39	–	3-1-39	+	2-23-39	–	2-23-39	–	2-1-39 2-23-39	– –	2-1-39	+	2-23-39	–	3-1-39	–	2-23-39	–	1-27-39	–

C = ENGORGED ON WHITE RATS INFECTED WITH CALIFORNIA (HERMSI) STRAIN OF SPIROCHETES.
T = TRANSMISSION
NUMBERS IN MOLT (HORIZONTAL) COLUMN = NUMBER OF DAYS AFTER LAST FEEDING
♂ OR ♀ INDICATE THE SEX OF THE TICK FOLLOWING THIS MOLT.
* NO FOURTH NYMPHAL STAGE IN THIS SERIES.

FIGURE 3.—Infective blood meal during the multiple feeding period in second nymphal stage.

TICK NO.	82	T	84	T	86	T	87	T	88	T	89	T	90	T	91	T	92	T	94	T
LARVAL FEEDING	8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38	
MOLT	15		15		16		15		14		15		16		15		19		15	
1ST NYMPHAL FEEDING	9-26-38	–	9-26-38	–	9-26-38	–	9-26-38	–	9-27-38	–	9-26-38	–	9-26-38	–	9-26-38	–	9-28-38	–	9-26-38	–
MOLT	16		17		17		17		16		16		16		16		16		16	
2ND NYMPHAL FEEDING	10-19-38 11-14-38C 1-6-39	– –	10-19-38 11-14-38C 12-30-39	– +	10-19-38 11-14-38C 12-30-38	– –	10-20-38 11-14-38C 12-16-38	– –	10-19-38 11-14-38C 12-30-38	– –	10-18-38 11-14-38C 12-22-38	– –	10-19-38 11-14-38C 12-30-38	– –	10-19-38 11-14-38C 12-22-38	– –	10-19-38 11-14-38C 12-22-38	– –	10-19-38 11-14-38C 1-27-38	– –
MOLT	27♂		20		19		34♂		21		28♀		28♀		33♂		25		21	
3RD NYMPHAL FEEDING			1-26-39	–	1-26-39	–			1-26-38	–							1-19-39	–	2-23-39	+
MOLT			21♀		19♀				19♀								19♂		22♀	
4TH NYMPHAL FEEDING																				
MOLT																				
ADULT FEEDING	2-10-39 2-23-39	– –	2-23-39	–	2-27-29	–	1-26-39 2-23-39	– –	2-23-39	–	2-15-39	–	2-1-39	+	2-1-39	–	2-10-39	–	3-29-39	+

FIGURE 3.—Continued. (See notes following first section of figure.)

TICK NO	97	T	98	T	99	T	100	T	102	T	103	T	105	T
LARVAL FEEDING	8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38		8-13-38	
MOLT	14		16		19		18		16		18		16	
1-ST NYMPHAL FEEDING	9-27-38	–	9-28-38	–	9-28-38	–	9-26-38	–	9-28-38	–	9-28-38	–	9-28-38	–
MOLT	18		17		16		16		16		15		16	
2-ND NYMPHAL FEEDING	10-20-38 11-14-38C 1-6-39	– –	10-19-38 11-14-38C 12-22-38	– –	10-19-38 11-14-38C 1-6-39	– –	10-19-38 11-14-38C 10-27-39	– –	10-20-38 11-14-38C 11-27-39	– – –	10-19-38 11-14-38C 12-14-38	– –	10-19-38 11-14-38C 1-6-39	– –
MOLT	32 ♀		51 ♀		20 ♂		20 ♂		23 ♂		21		19 ♀	
3-RD NYMPHAL FEEDING											1-28-39	–		
MOLT											19 ♀			
4-TH NYMPHAL FEEDING														
MOLT														
ADULT FEEDING	2-10-39	+	2 23 39	–	1-21-39	–	2-23-39	–	2-23-39	–	2-23-39	–	2-2-39	–

FIGURE 3.—Concluded (See notes following first section of figure.)

occurred before the adult stage was reached. Only the remaining 65 ticks are considered.

Infective feedings.—The infective feedings were as follows: 27 as larvae and first nymphs, 11 as first and second nymphs (fig. 2), and 26 at the second feeding in the second nymphal stage (fig. 3). One tick (No. 78) was not given an infective feeding but is included since it showed multiple feedings in the first nymphal stage and an unusually long premolting period.

Although it cannot be stated that all ticks were given equal opportunities for feeding, frequent occasions were afforded. Multiple feedings occurred in the first nymphal stage in one tick, in the second nymphal stage in 27 ticks, in the third nymphal stage in 26 ticks and in the fourth nymphal stage in 2 ticks. The period of multiple feedings between molts was approximately the same as in experiment 1, i. e., from October to January. Only 9 ticks molted regularly. In contrast, during the summer of 1939, April to August, 142 ticks were reared to adults and all molted regularly. The months of October to January were obviously a rest period in relation to molting, but not in relation to feeding.

Transmission.—Of the 65 ticks reared through to the adult stage, 34 were females and 31 males. Of the 38 ticks given 2 infective feedings, 18 were females and 20 males. Nine (50 percent) of the females were positive at one or more feedings, while 17 (81 percent) of the males showed successful transmission.

Of the total positives, 9 males and 5 females (53 percent) showed successful transmission during the multiple feeding period.

In the 2 experiments, of a total of 85 ticks reared to adults, 15 (8 males, 7 females) required only 2 nymphal stages; 65 (27 males, 38 females) required 3; and 5 (4 males, 1 female) required 4.

SUMMARY

During the period October to January, 75 of 85 *Ornithodorus hermsi* (88 percent) engorged more than once in one of the nymphal stages.

Of 58 ticks given 1 or more infective blood meals in the larval or first and second nymphal stages 38 (65 percent) later transmitted spirochetes. Nineteen (50 percent) of the "positive" ticks transmitted spirochetes during the multiple feeding period.

Of 26 ticks that received their infective blood meal during the multiple feeding period 6 (23 percent) subsequently transmitted spirochetes.

CONCLUSIONS

1. As observed under experimental conditions *O. hermsi* passes through a molting rest period during the fall and winter months, but may continue to ingest blood.

2. Ticks may acquire and transmit spirochetes during multiple feedings between molts

RELAPSING FEVER: DATA IMPLICATING *ORNITHODORUS HERMSI* AS A VECTOR IN NORTHERN IDAHO [1]

By Cornelius B. Philip, *Medical Entomologist*, and Gordon E. Davis, *Bacteriologist, United States Public Health Service*

In August 1937, two persons of a group of six staying in a summer cabin on Moscow Mountain, 6 miles northeast of Moscow, Idaho, developed proved cases of relapsing fever, while two others had illnesses characteristic of this disease. Moreover the histories of illnesses of at least two other persons that visited the same premises in previous years are suggestive of relapsing fever. A few ticks, which were later identified by Entomologist R. A. Cooley as *Ornithodorus hermsi*, were recovered from the cabin as early as 1931 by Dr. C. L. von Ende, of the University of Idaho.

This was the first record of this tick outside of California, where it is an accepted vector. More recently, however, it has been shown to be a transmitting agent in Colorado (Davis, 1939).

PREVIOUS HISTORY

The summer cabin involved was built about 1920 on a secluded, heavily timbered knoll of Moscow Mountain with open farm land on all sides. The two-storied cabin is constructed of rough pine lumber (but unusually tight), on a close-fitting rock and mortar foundation. It has double-boarded floors and building paper is tacked to the studding inside. The only animals seen or captured in the building have been occasional mice (*Microtus*). There are pack rats and chipmunks in the vicinity but neither appeared to have ingress. The owners were very fastidious about possible rodent infestation, even before knowledge of the presence of ticks.

Following correspondence with Professor Claude Wakeland, of the University of Idaho, regarding complaints by the owners and their friends of possible tick bites during overnight stops at the cabin, first noticed in 1931, one of us (C. B. P.) visited the cabin, first in company with the owner in June 1932, then in the same month in 1934 and also in 1936, and finally in September 1938. During the first visit, a live bait of white rats and a guinea pig in cages over wood shavings and building paper on the bedroom floor resulted in the capture of four adult ticks, two nymphs, and two larvae. The early stage ticks were engorged, having apparently fed on the white

[1] From the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

rats. None was captured during a brief visit in 1934. The above procedure also failed during a 10-day stop in 1936; however, one nymph was recovered from the bedding after biting one of us spending the night there. At this time nearby rodent habitations, particularly ground squirrel and pine squirrel nests, were examined and numbers of mice were trapped without finding any outside source of ticks.

Following the 1932 visit, the cabin was sealed as tightly as possible and fumigated heavily with cyanide gas. Except briefly in 1936, overnight stays by visitors were not resumed until 1938. In May and June of that year, week-end guests slept both upstairs and down without noticing any annoyance. During August, however, the cabin was occupied more or less continuously by the six people previously mentioned and by two of them for the entire month.

During a 4-day visit in September 1938, following the reported illnesses, a thorough recheck of the building, including the eaves, attic, subflooring, and the foundation, failed to reveal evidence of rodents, and only three nymphal ticks were taken by animal bait. One of us slept in the cabin for 3 nights and made several examinations by flashlight each night.

CASE HISTORIES

R. C. L., his wife and child, aged 29, 31, and 3 years, respectively, stayed at the cabin for 2 weeks beginning August 1, 1938, and during the first week skin reactions due to bites were noticed on all three. The parents slept in a double cot touching the wall at the head; the child slept separately in a bed not touching the wall, and had no subsequent illness. On August 18, both husband and wife became ill with chills, headache, and some vomiting and muscle soreness. The wife, being a graduate nurse, observed temperatures, hers reaching 103.6° on August 19, and her husband's 106° on August 20, on which date both returned home for treatment.

Each had three subsequent relapses, dates of onset of the husband's being August 26, September 2, and September 24, respectively, and of the wife's, August 30, September 11, and October 1. The latter was also somewhat indisposed about September 23. Blood films made by Drs. Bird and Myhre of Spokane on September 2, during the husband's third relapse, showed spirochetes. Mapharsen was administered to both at the onset of the third relapse. No further illness was experienced by either.

Also beginning August 1, R. W. H., aged 29, and his wife slept at the cabin in an adjoining room for about 2 weeks before bites were noticed. However, during the last week, Mr. H., on arising one morning, found one tick in the bedding and another attached between his shoulder blades. Unfortunately both specimens were destroyed.

Up to this time, all bites had been attributed by these people to bedbugs.

M. C., aged 13½ years, spent only 2 nights at the cabin, the first on August 11, the second on August 20, to take care of the L. child. She slept in the bed previously occupied by the L's but was not conscious of bites either night. Her first period of illness began August 26 with chills; maximum temperature was 104.5°. Relapses occurred on September 4, 10, 17, and 27 with fever, muscle soreness, headache, some nausea, and drenching sweats as the fever "broke"; maximum temperature observed was 106°F. during the third relapse. Spirochetes were found in the patient's blood by Drs. Loehr and Klaaren during the last two relapses and the diagnosis was confirmed by animal inoculation. Mapharsen was given on September 30 and no further relapses occurred.

Mrs. A. L. S., aged 75 years, had a presumed infection in August 1936, following week-end visits to the same cabin. About August 2, she felt weak and unable to do customary work. Several days were spent in bed with reported high fever, muscle soreness, chills, and a terminal drenching sweat. She remembered an unusual and persistently itching "mosquito bite" on the neck which was called to the attention of others of the family. A physician was subsequently consulted on August 11 and again on August 26 for "shingles and gall trouble." Both illnesses were accompanied by chills, low fever, and heavy sweating. There was also loss of weight. These illnesses may have been relapses due to a spirochete infection.

The owner of the cabin, a man 61 years of age, also had possible relapsing fever in late July and August 1931. He had five sudden onsets of fever and headache about a "week apart" followed by sweats that drenched the bedding. This illness was attributed to "summer flu."

In view of the fact that there are many other summer dwellings in the same area, the localization of both observed cases and the ticks to a single cabin is puzzling. The nearest known cases have been several near Trail, British Columbia (Palmer and Crawford, 1933), and one presumably infected near Walla Walla, Wash. (Tollefsen, 1935).

EXPERIMENTAL OBSERVATIONS

Daily blood examinations were made of the animals used as live bait (eight white rats and one guinea pig), with the results indicated below. The ticks taken were also tested by feeding on white rats, and part of them by subsequent injection into other rats.

1932.—Two rats and one guinea pig were exposed in the cabin for 3 days and nights; three other rats were bitten, respectively, by one, two, and three of the captured ticks; and two rats were injected with

three and four ticks each (including two each of those fed above). The blood films from six rats remained negative during an observation period of 3 weeks. One of the tick-injected rats died on the sixth day of unknown cause, but the films made up to that time were negative.

1938.—Six rats were exposed in two places in the cabin for 4 nights; three others were later bitten by the three nymphal ticks taken in the traps. All remained negative.

Blood films from two rats injected with blood from M. C., taken during the fourth relapse, showed nothing, but the brain of one and the spleen of the other, removed on the thirteenth and sixth days, respectively, each produced infection in one of three transfer rats.

One of two rats injected with blood from the same patient taken during the fifth relapse remained negative; the other showed spirochetes on the ninth day. This strain, after passage through other rats, was successfully transferred by the feeding of third-stage *O. hermsi* nymphs that fed on an infected rat in the preceding stage. The ticks used were from a proved noninfected stock from California.

Five other rats received, respectively, brain tissue from one field mouse (*Microtus*), two chipmunks, and two pine squirrels taken near the cabin. These brains had been preserved in 50 percent buffered glycerin. All test animals remained negative.

SUMMARY

The occurrence in a cabin on Moscow Mountain, Idaho, of relapsing fever cases in association with a known vector, *Ornithodorus hermsi*, is reported. Diagnosis was confirmed by laboratory procedure and one of the strains recovered was successfully passed between white rats by a previously noninfected California strain of *O. hermsi.*

ACKNOWLEDGMENT

It is a pleasure to acknowledge the cordial cooperation of the Moscow physicians concerned, particularly Drs. Loehr and Klaaren in whose laboratory some of the studies were performed. Drs. W. E. Shull and G. C. Holm, of the University of Idaho, also provided useful information and facilities.

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PROVISIONAL NATALITY AND MORTALITY FIGURES FOR 1939

According to provisional figures recently issued by the Bureau of the Census,[1] favorable health conditions, as interpreted by the general mortality rate, continued to prevail in the United States in 1939.

The provisional crude death rate for 1939 is given as 10.7 per 1,000 population, as compared with the same provisional rate in 1938 and a final rate of 10.6. A significant further reduction is shown in infant mortality, with a provisional rate of 48.2 per 1,000 live births as compared with a similar rate of 50.5 in 1938 and a final rate of 51.0 for that year. This is the first time that the infant mortality rate for the country as a whole has been below 50.

The provisional birth rate of 17.5 per 1,000 population in 1939 indicates a slight decline from the preliminary and final rates of 17.7 and 17.6, respectively, for 1938.

The following table gives the provisional figures for 1939 and 1938 and the final, complete figures for 1938. The birth and death rates are computed on the basis of the estimated population of the United States as of July 1, 1937. The population factor is not involved in the infant mortality rates, which are based on the number of live births.

	1939 provisional		1938			
			Provisional		Final	
	Number	Rate	Number	Rate	Number	Rate
Births [1]	2,083,475	17.5	2,140,000	17.7	2,286,962	17.6
Deaths [1]	1,287,278	10.7	1,287,046	10.7	1,381,391	10.6
Infant mortality [2]	88,651	48.2	96,944	50.5	116,702	51.0

[1] Rates per 1,000 estimated population as of July 1, 1937.
[2] Rates per 1,000 live births.

The provisional figures and rates for 1938 and 1939 are computed from monthly reports to the Bureau of the Census and for some States do not include the entire year. While the figures will not agree with the final, complete tabulations, there are certain compensatory factors which make them closely approximate the final figures, as may be seen by a comparison of the provisional and final figures for 1938.

If approximately the same proportionate difference between the preliminary and final figures obtains in 1939 as in 1938, a very slight increase in the number of deaths may be expected in 1939 as compared with the preceding year, but it appears unlikely that the death

[1] Monthly Vital Statistics Bulletin, vol. 2, No. 13 (February 7, 1940). Bureau of the Census, Depart-

rate will be more than 10.7 per 1,000 population. The final rate for 1939 may even be as low as the minimum (10.6) in 1938, especially if the estimated population as of July 1, 1937, is an underestimate for 1939.

BIRTHS IN NEW YORK STATE

According to a recent issue of Health News,[1] published by the New York State Department of Health, the birth rate for New York State during 1939 was 13.7, with one exception the lowest rate ever recorded. The rate for 1938 was 14.0, and the annual average for the years 1934–38 was 13.9. In connection with the decreasing birth rate, Dr. Joseph V. DePorte, Director of the Division of Vital Statistics, made the following interesting comment:

The reduction so far recorded in the birth rate seems to represent mainly the intentional limitation of size of family and not the attenuation of the natural instinct of parenthood. It may not be generally known that there has been little, if any, decrease in the number of first births, and that this has been true, only to slightly lesser degree. of second births. Here are some interesting figures drawn from the experience in our own State: In 1928 the total number of births in upstate New York was, in round numbers, 97,000; the number of first births, 29,000. Ten years later the number of all births was 88,000, a decrease of 9,000; while the number of first births (34,000) showed an increase of 5,000. The total birth rate has decreased from 17.5 to 14.4, but the corresponding number of first births in every 1,000 population has increased from 5.3 to 5.6. In the same decade there has been, also, a slight increase in the number of second births, from 22,000 to 23,000. The decrease in the total number of births has been due entirely to fewer births of the third and higher orders.

COURT DECISION ON PUBLIC HEALTH

County tax for promotion of public health.—(Mississippi Supreme Court, Division B; *Yazoo and M. V. R. Co.* v. *Bolivar County et al.*, 191 So. 426; decided October 16, 1939.) A 1932 law of Mississippi, as it applied to the defendant county, empowered the board of supervisors to levy an annual tax of not exceeding 5 mills for all general county purposes, exclusive only of levies for roads and bridges and schools. There was a proviso that counties having an assessed valuation of less than $8,000,000 and having no bonded indebtedness could levy an additional mill to maintain a full-time health unit. A 1938 statute authorized county boards of supervisors, in their discretion, to levy annually a special tax of not exceeding 1 mill for the treatment of the indigent sick and the promotion of the public health, and, further, provided that all revenue derived from the tax should be covered into the county public health fund and be subject to the appropriation of

[1] Health News, vol. 17, No. 9, February 26, 1940.

the boards of supervisors as the statutes provided for the purposes mentioned.

The defendant county, for the fiscal year 1938-39, levied a 5-mill general county tax and a 1-mill public health tax. Such county, having more than an $8,000,000 assessed valuation and a bonded indebtedness, did not come within the proviso of the 1932 law referred to above. In a suit to recover taxes paid under protest the plaintiff contended that, since the defendant county had levied the maximum 5 mills for all general county purposes, the additional 1-mill levy was excessive under the 1932 statute. In other words the contention was that the 1-mill levy provided for in the 1938 act should have been included in the 5 mills limitation for general county purposes under the 1932 act.

The supreme court affirmed the judgment of the lower court in favor of the county. The court said that the 1938 law had the effect of removing the proviso from the 1932 law. "It is clear," said the court, "that any county, under this chapter, is authorized to levy the 1 mill as a special tax, and that it was not intended to be included in the general county taxes."

NOTIFIABLE DISEASES IN THE UNITED STATES, 1938—A CORRECTION

In the morbidity and mortality summary for 1938, which appeared in the Public Health Reports for March 8, 1940, the figure for smallpox on page 426 should have been 14,939 instead of 49,319. The correct figure is given in the table on page 428 of the same issue of the Public Health Reports.

DEATHS DURING WEEK ENDED MARCH 2, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Mar. 2, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,346	10,021
Average for 3 prior years	9,500	
Total deaths, first 9 weeks of year	86,696	85,558
Deaths under 1 year of age	498	570
Average for 3 prior years	584	
Deaths under 1 year of age, first 9 weeks of year	4,831	5,004
Data from industrial insurance companies:		
Policies in force	66,104,679	67,876,040
Number of death claims	15,157	16,095
Death claims per 1,000 policies in force, annual rate	12.0	12.4
Death claims per 1,000 policies, first 9 weeks of year, annual rate	10.5	10.3

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MARCH 16, 1940

Summary

The incidence of all of the 9 important communicable diseases reported weekly by telegraph to the United States Public Health Service was below the median expectancy for the week ended March 16, based on the figures for the median week of the years 1935–39.

As compared with the preceding week, the number of cases of influenza dropped from 9,590 to 6,740, and all of the other diseases registered a decline except poliomyelitis, scarlet fever, and typhoid fever. The number of cases of poliomyelitis increased from 12 to 19, with 3 cases, the largest number reported from any one State, being recorded for Texas.

For the first 11 weeks of the current year, the accumulated totals for all of these 9 diseases, except influenza and poliomyelitis, have remained below the medians for the corresponding period of the years 1935–39. This favorable condition applies to most of the geographic areas. The incidence of diphtheria has been about 65 percent of the median expectancy, of measles about 40, of meningococcus meningitis about 30, of scarlet fever about 70, of typhoid fever about 60, and of smallpox about 25 percent.

For the current week, 27 cases of smallpox were reported in Oklahoma (42 cases for the preceding week), 1 case of Rocky Mountain spotted fever was reported in Virginia, 1 case of undulant fever and 1 case of tularaemia were reported in Maryland, and a total of 14 cases of endemic typhus fever was reported, of which 7 cases occured in Texas and 4 cases in Georgia.

Telegraphic morbidity reports from State health officers for the week ended March 16, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939	
NEW ENG.												
Maine	2	0	1	12	30	15	356	28	28	1	0	0
New Hampshire	0	0	0	------	40	------	30	0	18	0	0	0
Vermont	0	0	0	------	------	------	4	46	46	0	0	0
Massachusetts	2	2	3	------	------	------	311	905	864	0	2	2
Rhode Island	0	0	0	------	------	------	138	6	64	1	0	0
Connecticut	1	1	2	7	20	18	156	522	522	1	1	0
MID. ATL.												
New York	15	28	34	[1] 33	[1] 38	[1] 38	383	1,408	2,293	2	1	14
New Jersey	4	5	14	23	13	25	280	48	1,106	0	1	2
Pennsylvania	11	55	42	------	------	------	40	216	865	[2] 7	6	6
E. NO. CEN.												
Ohio	12	37	26	217	------	48	17	27	389	2	3	11
Indiana	6	11	12	61	210	36	8	14	60	0	2	2
Illinois	21	44	44	35	541	70	113	22	70	3	0	8
Michigan [3]	9	11	11	23	220	5	178	248	243	5	0	0
Wisconsin	2	2	2	224	1,484	67	267	1,073	1,073	1	1	1
W. NO. CEN.												
Minnesota	14	3	3	1	22	------	179	831	384	0	0	0
Iowa	2	5	5	28	643	8	196	172	133	0	0	1
Missouri	20	9	16	16	452	253	9	22	22	0	0	2
North Dakota	6	1	2	44	254	4	6	78	28	0	0	0
South Dakota	1	0	0	2	22	------	1	134	5	0	0	0
Nebraska	0	3	3	------	22	4	107	53	46	1	1	1
Kansas	11	3	7	31	205	40	533	20	20	0	0	2
SO. ATL.												
Delaware	0	1	0	------	------	------	4	0	32	0	0	0
Maryland [3]	5	3	4	57	79	45	3	798	199	1	2	4
Dist. of Col.	6	8	7	------	3	3	5	39	49	0	0	2
Virginia [4]	10	20	24	552	2,443	------	44	376	376	3	2	6
West Virginia [3]	4	7	10	610	218	218	17	4	20	1	2	7
North Carolina	16	13	13	8	172	172	141	1,286	699	0	1	1
South Carolina [5]	2	6	5	774	872	872	7	12	41	0	0	1
Georgia [5]	11	8	9	144	286	286	254	205	0	1	0	2
Florida	1	6	8	9	5	14	92	119	100	0	0	3
E. SO. CEN.												
Kentucky	3	7	12	69	560	93	25	89	190	0	2	6
Tennessee	6	9	12	238	420	416	95	165	165	0	5	5
Alabama [5]	14	6	8	335	1,862	1,862	124	190	190	3	7	7
Mississippi [3]	3	8	4	------	------	------	------	------	------	0	1	1
W. SO. CEN.												
Arkansas	7	7	6	334	577	211	36	39	37	0	0	0
Louisiana	1	12	16	62	27	27	26	154	68	1	1	0
Oklahoma	3	3	6	491	682	287	7	194	126	1	0	5
Texas [5]	36	50	44	1,761	1,718	880	811	277	277	1	4	4
MOUNTAIN												
Montana	0	0	3	11	145	32	31	304	18	0	0	0
Idaho	0	0	0	2	4	4	39	71	13	0	1	0
Wyoming	0	0	1	5	------	------	19	62	29	0	0	0
Colorado	6	11	8	29	73	------	30	253	253	0	0	0
New Mexico	1	4	5	7	670	26	37	25	35	0	1	1
Arizona	2	5	2	224	476	130	95	19	38	0	5	1
Utah [3]	2	2	0	8	86	------	315	105	23	0	0	0

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 16, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939	
PACIFIC												
Washington	1	2	2	11	-----	1	653	421	221	0	1	1
Oregon	10	4	0	31	118	83	421	45	45	0	0	1
California	26	36	35	211	209	215	533	4,248	885	3	1	4
Total	315	458	470	6,740	15,921	8,852	7,176	15,373	15,373	39	54	159
11 weeks	4,379	5,828	6,797	140,504	85,103	85,103	59,774	136,721	136,721	[2] 428	587	1,320

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939	
NEW ENG.												
Maine	0	0	0	11	17	17	0	0	0	0	0	0
New Hampshire	0	0	0	0	2	11	0	0	0	0	0	0
Vermont	0	0	0	8	6	10	0	0	0	0	0	0
Massachusetts	1	0	0	102	169	287	0	0	0	2	2	2
Rhode Island	0	0	0	18	11	22	0	0	0	0	0	0
Connecticut	0	0	0	89	91	130	0	0	0	0	1	0
MID. ATL.												
New York	1	0	1	1,049	673	1,052	0	0	0	3	6	6
New Jersey	0	0	0	358	160	190	0	0	0	3	4	1
Pennsylvania	2	0	0	257	436	533	0	0	0	6	8	6
E. NO. CEN.												
Ohio	1	1	1	343	558	445	0	21	1	4	2	2
Indiana	0	1	0	275	207	212	1	42	5	1	1	1
Illinois	0	0	1	870	446	874	2	10	13	2	4	8
Michigan [3]	2	0	0	383	442	442	0	17	2	3	1	8
Wisconsin	1	1	0	153	186	407	3	5	7	0	1	1
W. NO. CEN.												
Minnesota	0	0	0	88	105	160	1	11	11	1	1	1
Iowa	0	0	0	62	157	233	4	23	23	1	1	1
Missouri	0	1	1	102	77	216	2	8	8	5	2	2
North Dakota	0	0	0	14	28	30	6	3	3	0	0	0
South Dakota	0	0	0	5	12	16	1	4	4	0	0	0
Nebraska	0	0	0	20	30	57	1	15	15	0	0	0
Kansas	1	0	0	67	130	189	0	5	14	0	0	1
SO. ATL.												
Delaware	0	0	0	17	5	6	0	0	0	0	0	0
Maryland [3]	0	0	0	42	47	87	0	0	0	2	1	1
Dist. of Col.	0	0	0	18	20	20	0	0	0	0	0	0
Virginia [4]	0	0	0	36	33	50	0	0	0	2	8	8
West Virginia [3]	0	0	0	50	58	68	0	0	0	0	3	8
North Carolina	1	0	0	26	47	41	0	1	1	0	0	1
South Carolina [5]	0	0	0	3	4	4	0	0	0	2	0	0
Georgia [5]	0	0	0	17	5	11	5	0	0	3	3	2
Florida	0	1	0	5	10	10	0	0	0	1	3	3

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 16, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939		Mar. 16, 1940	Mar. 18, 1939	
E. SO. CEN.												
Kentucky	1	0	0	94	68	50	0	7	0	1	4	8
Tennessee	0	0	0	81	59	50	1	0	0	2	2	2
Alabama [5]	0	0	0	23	14	14	0	0	0	2	2	1
Mississippi [3]	0	1	0	5	5	6	1	0	0	2	2	2
W. SO. CEN.												
Arkansas	1	0	0	2	11	10	3	1	2	2	4	2
Louisiana	1	0	0	14	7	13	1	2	3	9	17	9
Oklahoma	0	0	0	15	62	25	27	55	14	5	0	2
Texas [5]	3	1	1	39	71	94	2	27	7	3	14	14
MOUNTAIN												
Montana	0	0	0	26	28	28	0	2	9	0	0	0
Idaho	0	0	0	10	21	22	0	3	3	1	1	1
Wyoming	0	0	0	6	9	10	0	0	0	0	0	0
Colorado	0	0	0	29	51	67	10	0	6	0	0	1
New Mexico	0	0	0	13	30	30	2	2	0	8	0	2
Arizona	0	1	0	10	7	16	0	0	1	0	1	1
Utah [3]	0	0	0	27	29	47	1	0	1	1	0	0
PACIFIC												
Washington	0	0	0	53	46	47	0	6	25	3	0	2
Oregon	1	0	0	24	49	49	0	18	18	3	1	1
California	2	1	4	193	290	269	2	39	18	5	1	4
Total	19	9	21	5,152	5,029	7,900	76	327	327	88	101	101
11 weeks	306	170	228	51,089	58,995	73,363	810	4,250	3,297	827	1,296	1,296

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 16, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended— Mar. 16, 1940	Whooping cough, Week ended— Mar. 18, 1939
NEW ENG.		
Maine	32	33
New Hampshire	5	1
Vermont	35	68
Massachusetts	171	161
Rhode Island	6	28
Connecticut	29	116
MID. ATL.		
New York	319	560
New Jersey	86	410
Pennsylvania	225	361
E. NO. CEN.		
Ohio	235	199
Indiana	47	39
Illinois	92	265
Michigan [3]	188	148
Wisconsin	102	232
W. NO. CEN.		
Minnesota	23	41
Iowa	5	7
Missouri	31	40
North Dakota	3	4
South Dakota	0	0
Nebraska	3	0
Kansas	57	17
SO. ATL.		
Delaware	5	4
Maryland [3]	210	33
Dist. of Col	15	20
Virginia [4]	52	122
West Virginia [3]	62	43
North Carolina	108	346
SO. ATL.—continued		
South Carolina [5]	14	76
Georgia [5]	9	51
Florida	5	28
E. SO. CEN.		
Kentucky	51	19
Tennessee	40	35
Alabama [5]	31	30
Mississippi [3]		
W. SO. CEN.		
Arkansas	2	18
Louisiana	30	2
Oklahoma	3	1
Texas [5]	208	114
MOUNTAIN		
Montana	5	5
Idaho	28	3
Wyoming	3	5
Colorado	6	71
New Mexico	53	12
Arizona	14	25
Utah [3]	123	36
PACIFIC		
Washington	61	27
Oregon	30	13
California	241	155
Total	3,103	4,024
11 weeks	31,804	46,440

[1] New York City only.
[2] According to later information 5 cases of meningococcus meningitis were reported in Pennsylvania for the week ended March 9, instead of 6 as reported in Public Health Reports of March 15, 1940, p. 476.
[3] Period ended earlier than Saturday.
[4] Rocky Mountain spotted fever, week ended March 16, 1940, Virginia, 1 case.
[5] Typhus fever, week ended March 16, 1940, 14 cases as follows: South Carolina, 1; Georgia, 4; Alabama 2; Texas, 7.

SUMMARY OF MONTHLY REPORTS FROM STATES

[The following tables complete the summarization of the monthly State reports for 1939]

Division and State	Actino-mycosis	Anthrax	Beri-beri	Chick-enpox	Con-juncti-vitis	Dengue	Diar-rhea	Diph-theria	Dysen-tery, amoebic	Dysen-tery, bacil-lary	Dysen-tery, unspeci-fied	En-cepha-litis, epi-demic or le-thargic	Food poison-ing	German measles	Granu-loma, cocci-dioidal
October 1939															
Massachusetts				333				24		164		1		40	
Puerto Rico				8				51			27				
November 1939															
Massachusetts		1		947				27		135				34	
Rhode Island				100				2		17				4	
Indiana				315				91		2					
Illinois	2			1,559				142	5	19		2		25	
Wisconsin				2,529				6				5		32	
District of Columbia				61				16	2						
Virginia				92				290	1	84					
North Carolina				290				476		4				7	
South Carolina				46			292	200						10	
Florida				32				34	7			1			
Arizona				65				25			66	1		3	
Utah				355				3		2	2	2		17	
Nevada				30											
Washington				657	7			13	1			3	1	19	
Oregon				245				3	2						
Alaska				11				1							
Hawaii Territory				33	24			10	2						
Puerto Rico				9				48			15				
December 1939															
NEW ENG.															
Maine				362				9				1		10	
New Hampshire				83				2							
Vermont				309				1						14	
Massachusetts				1,511				20		26		1		26	
Rhode Island				132				3				1		2	
Connecticut				617	2			2		65				5	
MID. ATL.															
New York		1		3,274				72	6	73		6		79	
New Jersey		1		1,755				53				3		33	
Pennsylvania		5		4,803				151	1	2		2		37	

E. NO. CEN.															
Ohio				1,729				114		1				14	
Indiana				3 3				102		3					
Illinois				2 211				134	8	21		2		25	
Michigan	1			2 277				32	2	5				42	
Wisconsin				3,548											
W. NO. CEN.															
Minnesota				1,344				6							
Iowa				432				35				1		4	
Missouri				191				67		1					
North Dakota	1			132	2			4						3	
South Dakota				209				15				1			
Nebraska				104				8							
Kansas				651				29		1	1	7		14	
SO. ATL.															
Delaware				75				3							
Maryland				401			14	41						8	
District of Columbia				145				11	3	13					
Virginia				305				181							
West Virginia				210				66	1	137		11			
North Carolina				428				269						13	
South Carolina				199		1	337	167				2		14	
Georgia				283	7			92	4	15	1				
Florida				79				29	4						
E. SO. CEN.															
Kentucky				431				67		6		1		2	
Tennessee				282				73	1	8		1		8	
Alabama				143				143	2			1			
Mississippi				514		5		57	83	201					
W. SO. CEN.															
Arkansas				110				73	1	8				1	
Louisiana				46				51	4	3		2			
Oklahoma				149				73	3	11					
Texas				721				280	9	51		1			
MOUNTAIN															
Montana				251				4				11		4	
Idaho				108	1									7	
Wyoming				135				4						5	
Colorado				235				37				1			
New Mexico				123			5	14	4	15			1	1	
Arizona				121				33			48				
Utah				374				5	1		3			12	
Nevada				24											

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Summary of monthly reports from States—Continued

Division and State	Actinomycosis	Anthrax	Beriberi	Chickenpox	Conjunctivitis	Dengue	Diarrhea	Diphtheria	Dysentery, amoebic	Dysentery, bacillary	Dysentery, unspecified	Encephalitis, epidemic or lethargic	Food poisoning	German measles	Granuloma, coccidioidal
PACIFIC															
Washington				711				6				1	20	20	
Oregon				329				15	2						
California	2		1	1,756				119	10	52		2	97	48	3
Total (December)	4	7	1	34,812	12	6	356	2,822	154	754	53	59	118	457	3
Alaska				13											
Hawaii Territory				58	2			5							
Puerto Rico				15				55			15				

Division and State	Hookworm disease	Impetigo contagiosa	Influenza	Jaundice, infectious	Lead poisoning	Leprosy	Malaria	Measles	Meningitis, meningococcus	Mumps	Ophthalmia neonatorum	Pellagra	Plague, human	Poliomyelitis	Psittacosis	Puerperal septicemia
October 1939																
Massachusetts								291	5	91	65	1		21		
Puerto Rico			51			1	2,518	83		3	7					5
November 1939																
Massachusetts							1	857	2	218	82	1		6		
Rhode Island								263		210						
Indiana			22					55	2	257				10		
Illinois			62				22	90	4	159	3	2		12		
Wisconsin			77					100	1	793				18		
District of Columbia			3					7	2					3		
Virginia			387				15	29	5			9		4		
North Carolina			14				33	523	2			11		6		
South Carolina	62		1,640				716	15	3	15	3	68		7		
Florida	555		14				42	25	2	6		8		2		
Arizona			272				3	12	2	69				1		
Utah			136	1				294		164				24		
Nevada								6								

Washington		3	6					1,373	1	45				5		
Oregon		99	69					81	4	111				8		
Alaska		1						172								
Territory of Hawaii	13	32	2	1		3		2		33	2			4		
Puerto Rico			103				2,737	13		4	3					4
December 1939																
NEW ENG.																
Maine			14					210	2	5				1		
New Hampshire								17		22				0		
Vermont								115		50				0		
Massachusetts							4	1,0[illegible]	1	346	130	2		6		
Rhode Island								374	2	147				0		
Connecticut			12				1	265	1	210				1		
MID. ATL.																
New York							13	1,753	5		8			23		
New Jersey			52				1	65	1	753	13			2		
Pennsylvania							2	229	34	964	8			9		
E. NO. CEN.																
Ohio		32	125		4		1	93	9	430				4		1
Indiana			73					30	5	244				2		
Illinois		14	63				8	81	8	332	5	1		6		
Michigan			19	5			10	1,372	8					10		
Wisconsin			147					379		862				10		
W. NO. CEN.																
Minnesota			10					342						14		
Iowa			36					214		370				32		
Missouri			10					28	1	33		1		8		
North Dakota			178					29		138				1		
South Dakota			3					20		15				8		
Nebraska								13	1	166				4		
Kansas		10	421		1			478	7	182				8		
SO. ATL.																
Delaware								8	1	1				2		
Maryland		9	57	1				16	2	11		1		3		
District of Columbia			8					8								
Virginia			652				2	83	1	59		2		3		
West Virginia			67					27	9	5				10		
North Carolina			204				34	734	4			3		2		
South Carolina	79		8,779				402	21	4	38	1	101		4		
Georgia	2,234		3,005				142	76	2	95		10		1		
Florida	804		56				26	6	1	13		4				

Summary of monthly reports from States—Continued

Division and State	Hookworm disease	Impetigo contagiosa	Influenza	Jaundice, infectious	Lead poisoning	Leprosy	Malaria	Measles	Meningitis, meningococcus	Mumps	Ophthalmia neonatorum	Pellagra	Plague, human	Poliomyelitis	Psittacosis	Puerperal septicemia
E. SO. CEN.																
Kentucky			23					23	7	75		3		14		
Tennessee	1	8	252				36	215	6	33	1	9		1		1
Alabama			2,911				145	56	6	44		12		3		
Mississippi			9,445				1,099	279	6	184	9	193		1		23
W. SO. CEN.																
Arkansas	18		365				66	3		18		18		4		1
Louisiana	28		24			1	20	9		3	1	6		1		
Oklahoma			479				29	14	3	24		6		7		
Texas			2,074			1	252	259	5	134	2	116		12		
MOUNTAIN																
Montana		10	1,742					44	1	181						
Idaho			23					175	1	45				6		
Wyoming			709					36		143				1		
Colorado			611					93	5	218				9		
New Mexico			18					10	1	76		2		6		
Arizona			102				1	20		101		4		5	3	
Utah			2,558					282		112			1	15		
Nevada			6					2								
PACIFIC																
Washington			15					2,234	2	48				3		
Oregon		28	715					199	3	167				2		
California			245	5			8	808	5	908	1	3		37		
Total (December)	3,154	111	36,303	11	5	2	2,302	12,889	155	8,059	169	502	1	286	3	26
Alaska		10						140								
Hawaii Territory	4	20	11	1		1		5		46	1		1	12		
Puerto Rico			187				2,581	36	1	1	1			1		7

Division and State	Rabies in animals	Rabies in man	Rat bite fever	Rocky Mountain spotted fever	Scarlet fever	Septic sore throat	Smallpox	Tetanus	Trachoma	Trichinosis	Tularaemia	Typhoid and paratyphoid fever	Typhus fever	Undulant fever	Vincent's infection	Whooping cough
October 1939																
Massachusetts	3				179	10		2		2		7		4		347
Puerto Rico					1			13				28				141
November 1939																
Massachusetts	13				294	10				2		3		5		508
Rhode Island	2				25	8						1			1	96
Indiana	41	1			510	20	8				6	19		8		162
Illinois	15				1,153	2	2	4	13	2	90	35		15	29	696
Wisconsin					514	7	10				11			4		541
Dist. of Col					52						1	7		1		56
Virginia					227	93		1			8	23	1			116
North Carolina		1			464	15	1				2	9	4	6	1	275
South Carolina	14				92						1	40	20			33
Florida	3				42	8		3			14	8	5	7	4	37
Arizona					34				36			6		1		45
Utah				2	93	2	2		13		2	5		4		385
Nevada					36							1				6
Washington	9				162	3	4					18		2	4	90
Oregon	5				93	1	1		2			13			11	101
Alaska						5						1				8
Hawaii Territory								2	3	2		6	9			186
Puerto Rico								7				39				139
December 1939																
NEW ENG.																
Maine					68	3						5		2	6	229
New Hampshire					5							1		2		25
Vermont					21							3		6		166
Massachusetts	3				412	22		2		1		7		2		510
Rhode Island	4				40	17								1		86
Connecticut					244	20		1		9		4		7		324
MID. ATL.																
New York	18				1,447	128		2		13	1	258	1	26	43	1,822
New Jersey	26				763	20		2		1	2	13		7		498
Pennsylvania					1,346					1	16	32		12		1,236

Summary of monthly reports from States—Continued

Division and State	Rabies in animals	Rabies in man	Rat bite fever	Rocky Mountain spotted fever	Scarlet fever	Septic sore throat	Smallpox	Tetanus	Trachoma	Trichinosis	Tularaemia	Typhoid and paratyphoid fever	Typhus fever	Undulant fever	Vincent's infection	Whooping cough
E. NO. CEN.																
Ohio					1,336	14	6		3		59	32		11		547
Indiana	22				654	5	16				40	4		9		196
Illinois	17				1,462	5	7	1	11		252	24		16	20	456
Michigan	3				1,364	73	2		1	2	5	16		7	16	564
Wisconsin					588	19	18				23	7		14		543
W. NO. CEN.																
Minnesota					541	16	72				2	5		7		217
Iowa					417	27	43				79	1		23	4	107
Missouri					376	12	14	2	10		98	19		3		72
North Dakota					155		1		2		1				3	59
South Dakota					95	1	24		1			1				4
Nebraska					93		5					2				22
Kansas					499	27			45		48	2		4	8	71
SO. ATL.																
Delaware					69							1				32
Maryland					226	20		1			36	18	2	5	14	236
District of Columbia					34						2	4				50
Virginia				3	230	162					17	23		1		132
West Virginia		1			374	8	2				9	15				75
North Carolina					366	6	2				3	10	19	1		254
South Carolina	6				91			4			5	8	12	2		80
Georgia					190	145	1				8	22	98	10		47
Florida					38	2	1	2			7	9	11		4	
E. SO. CEN.																
Kentucky					256	34			13		45	6		2	10	217
Tennessee			1		367	20	1	1			27	14	31	2	10	157
Alabama	17	1			218		2	3			1	4	32	7		76
Mississippi	5				58				7			6	7	2		623
W. SO. CEN.																
Arkansas	17				72	36	16		38		13	17				22
Louisiana	26				78	4	1	6	3		8	24	17	4		68
Oklahoma	21	1			115	42	22				28	20		28	20	13
Texas	2				231		15		15		2	76	32	34		845

MOUNTAIN																
Montana					142	10	5		5			1				30
Idaho	1				40							2		1		2
Wyoming					56	1					2	2			2	52
Colorado					171	2	96				3	2		1		53
New Mexico	1				100	10	5				1	17				148
Arizona					30		2		34			3		1		31
Utah					66	14	5		2		2	6				252
Nevada					8											1
PACIFIC																
Washington	8			1	197	6	4	1				10		5	1	65
Oregon	2				108	3	3		1			5		1	6	146
California	12				697	3	17	7	6	3	2	26	3	17		522
Total (December)	211	3	1	4	16,604	937	408	35	197	30	847	787	205	283	167	11,483
Alaska														6	1	10
Hawaii Territory					1			2				2	7			95
Puerto Rico								10				42				138

WEEKLY REPORTS FROM CITIES

City reports for week ended March 2, 1940

This table summarizes the reports received weekly from a selected list of 140 cites for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	167	912	140	7,036	969	2,305	82	400	20	1,172	--------
Current week [1]	75	773	98	1,563	617	1,703	5	387	14	901	--------
Maine:											
Portland	1	------	0	69	5	1	0	0	0	9	25
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	7
Manchester	0	------	0	7	1	3	0	0	0	0	14
Nashua	0	------	0	96	0	0	0	0	0	0	7
Vermont:											
Barre	0	------	0	0	0	0	0	1	0	0	2
Burlington	0	------	0	0	0	0	0	0	0	1	9
Rutland	0	------	0	0	1	0	0	1	0	0	7
Massachusetts:											
Boston	1	------	2	16	23	37	0	9	1	37	223
Fall River	0	------	0	13	1	0	0	0	0	3	35
Springfield	0	------	0	0	2	14	0	0	0	0	43
Worcester	0	------	0	2	4	5	0	2	0	0	62
Rhode Island:											
Pawtucket	0	------	0	1	0	1	0	0	0	0	17
Providence	0	------	1	153	3	11	0	3	0	8	80
Connecticut:											
Bridgeport	0	1	1	0	1	1	0	1	0	0	29
Hartford	1	------	0	1	2	1	0	0	0	4	40
New Haven	1	2	1	0	2	0	0	0	0	15	50
New York:											
Buffalo	0	------	0	1	14	9	0	2	0	12	132
New York	18	68	11	61	105	533	0	75	0	108	1,581
Rochester	0	2	0	0	4	18	0	2	0	14	70
Syracuse	0	------	0	0	2	6	0	1	1	21	39
New Jersey:											
Camden	3	1	1	0	2	9	0	2	0	0	42
Newark	1	1	0	29	3	24	0	9	0	29	114
Trenton	0	------	0	0	1	3	0	6	0	0	44
Pennsylvania:											
Philadelphia	3	5	1	41	39	67	0	28	2	49	556
Pittsburgh	2	9	7	1	15	33	0	9	0	19	161
Reading	0	------	1	1	0	0	0	1	0	22	24
Scranton	0	------	--------	0	-------	4	0	-------	0	0	--------
Ohio:											
Cincinnati	0	9	1	0	10	14	0	8	0	18	153
Cleveland	0	106	3	2	13	29	0	14	0	31	213
Columbus	2	4	4	0	12	11	0	4	0	11	121
Toledo	0	------	0	2	4	21	0	4	0	16	64
Indiana:											
Anderson	0	------	0	0	1	3	0	0	0	6	9
Fort Wayne	0	------	0	0	1	3	0	3	0	1	28
Indianapolis	1	------	3	4	14	20	0	3	0	13	124
Muncie	0	------	0	1	1	4	0	0	0	1	12
South Bend	0	------	0	0	2	0	0	0	0	0	17
Terre Haute	1	------	1	0	1	2	0	0	0	0	12
Illinois:											
Alton	0	1	1	0	0	2	0	0	0	0	9
Chicago	2	26	7	20	37	412	0	46	1	40	767
Elgin	0	1	0	0	1	1	0	0	0	0	9
Moline	0	------	0	1	0	1	0	0	0	0	5
Springfield	0	1	0	0	4	3	0	0	0	8	28
Michigan:											
Detroit	1	6	0	41	15	86	0	16	0	17	269
Flint	0	------	0	0	5	7	0	0	0	11	29
Grand Rapids	0	------	0	2	2	27	0	0	0	5	38
Wisconsin:											
Kenosha	0	------	0	2	1	3	0	0	0	1	11
Madison	0	------	0	1	1	2	0	1	0	5	28
Milwaukee	0	------	0	9	3	39	0	3	0	10	120
Racine	0	------	0	2	0	3	0	0	1	1	12
Superior	1	------	0	58	0	2	0	0	0	0	5

[1] Figures for Raleigh, Boise, and Tacoma estimated; reports not received.

City reports for week ended March 2, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0		1	160	1	4	0	0	0	5	20
Minneapolis	0		1	1	14	25	0	1	0	9	115
St. Paul	0	1	1	0	4	6	0	1	0	11	60
Iowa:											
Cedar Rapids	0			6		1	0		0	0	
Davenport	2				1		3	0		0	0
Des Moines	1		0	6	0	9	0	0	0	0	40
Sioux City	0			2		1	0		0	0	
Waterloo	0			1		2	0		0	0	
Missouri:											
Kansas City	0	1	4	1	15	21	0	6	1	0	131
St. Joseph	1		1	0	6	1	0	0	0	1	34
St. Louis	4	2	0	1	14	14	1	5	2	15	216
North Dakota:											
Fargo	0		1	2	0	2	0	0	0	0	8
Grand Forks	0			0		0	0		0	1	
Minot	0		0	0	0	1	0	0	0	0	7
South Dakota:											
Aberdeen	0			1		0	0		0	0	
Sioux Falls	0		0	0	0	1	0	0	0	0	8
Nebraska:											
Lincoln	0			0		3	0		0	0	
Omaha	0		0	6	8	1	0	0	0	3	62
Kansas:											
Lawrence	0	12	0	0	0	0	0	0	0	0	4
Topeka	0		0	1	3	0	0	8	0	0	32
Wichita	5		0	337	4	1	0	2	0	0	42
Delaware:											
Wilmington	0		0	0	2	4	0	0	0	4	32
Maryland:											
Baltimore	2	12	1	1	18	10	0	13	0	181	248
Cumberland	0		0	0	0	1	0	1	0	0	24
Frederick	1		0	0	0	0	0	0	0	0	2
Dist. of Col.:											
Washington	4	6	2	2	9	26	0	7	0	6	155
Virginia:											
Lynchburg	0		0	0	2	2	0	0	0	2	10
Norfolk	1	36	0	4	5	1	0	0	0	3	29
Richmond	0		2	0	7	2	0	0	1	1	47
Roanoke	0		0	0	3	2	0	1	0	5	21
West Virginia:											
Charleston	0	3	0	0	3	0	0	2	0	0	35
Huntington	0			0		3	0		0	0	
Wheeling	0		0	0	3	0	0	1	0	0	21
North Carolina:											
Gastonia	0			2		0	0		0	0	
Raleigh											
Wilmington	0		0	1	0	0	0	1	0	0	11
Winston-Salem	0		0	0	3	2	0	1	0	0	21
South Carolina:											
Charleston	0	96	0	0	4	0	0	1	0	0	29
Florence	0	10	0	0	0	0	0	0	0	0	5
Greenville	0		0	0	2	1	0	0	0	1	16
Georgia:											
Atlanta	0	17	3	10	9	8	0	7	0	1	102
Brunswick	0		0	1	2	0	0	1	0	0	8
Savannah	0	106	0	2	2	2	0	1	0	1	37
Florida:											
Miami	0	1	3	0	2	0	0	2	0	0	41
Tampa	3	3	3	62	0	0	0	1	0	0	25
Kentucky:											
Ashland	1		0	0	2	3	0	0	0	2	6
Covington	1		0	0	1	4	0	0	0	0	13
Lexington	1		1	0	5	3	0	1	0	0	18
Louisville	0	33	1	2	2	20	0	1	0	26	64
Tennessee:											
Knoxville	0		3	1	5	15	0	1	0	0	42
Memphis	1	11	6	5	4	20	4	1	3	6	96
Nashville	0		3	15	7	4	0	2	0	5	67
Alabama:											
Birmingham	0	16	0	0	6	5	0	4	0	4	64
Mobile	0	12	3	0	4	8	0	0	0	0	29
Montgomery	1	13		7		1	0		0	1	
Arkansas:											
Fort Smith	0	12		0		1	0		0	0	
Little Rock	0	48	1	0	6	1	0	0	0	0	

City reports for week ended March 2, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Louisiana:											
Lake Charles	0	------	0	2	0	0	0	1	1	0	6
New Orleans	1	23	3	5	15	8	0	17	0	26	166
Shreveport	0	------	0	0	15	2	0	2	1	1	74
Oklahoma:											
Oklahoma City	0	------	0	2	4	4	0	2	0	0	44
Tulsa	0	------	------	0	------	2	0	------	0	15	------
Texas:											
Dallas	2	17	4	12	7	2	0	2	0	11	77
Fort Worth	0	------	0	0	5	0	0	0	0	18	42
Galveston	1	------	0	13	2	2	0	1	0	0	21
Houston	2	10	3	8	10	1	0	8	0	2	112
San Antonio	0	40	1	42	15	2	0	7	0	2	82
Montana:											
Billings	0	------	0	0	0	1	0	1	0	0	12
Great Falls	0	------	0	0	1	4	0	0	0	0	14
Helena	0	------	0	2	0	1	0	0	0	0	5
Missoula	0	------	0	0	1	0	0	0	0	4	7
Idaho:											
Boise	------	------	------	------	------	------	------	------	------	------	------
Colorado:											
Colorado Springs	0	------	0	0	1	1	0	1	0	4	14
Denver	5	------	1	9	9	3	0	0	0	2	88
Pueblo	0	------	0	0	3	3	0	0	0	1	10
New Mexico:											
Albuquerque	0	------	0	0	0	2	0	3	0	6	12
Utah:											
Salt Lake City	0	------	1	73	1	5	0	0	0	49	36
Washington:											
Seattle	0	------	3	185	2	9	0	5	0	5	110
Spokane	0	------	0	2	3	6	0	1	0	1	31
Tacoma	------	------	------	------	------	------	------	------	------	------	------
Oregon:											
Portland	5	5	0	210	3	5	1	4	0	6	89
Salem	0	------	------	13	------	2	0	------	0	2	------
California:											
Los Angeles	1	100	3	18	7	38	0	17	0	10	421
Sacramento	0	3	0	3	0	1	0	2	0	5	24
San Francisco	3	5	1	3	7	9	0	8	0	5	203

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				West Virginia:			
Boston	1	1	0	Wheeling	1	0	0
New York:				South Carolina:			
Buffalo	1	0	0	Florence	0	1	0
New York	3	0	0	Tennessee:			
Illinois:				Memphis	1	1	0
Chicago	2	0	0	Louisiana:			
Michigan:				New Orleans	2	0	0
Detroit	1	0	0	Shreveport	0	1	0
Maryland:				California:			
Baltimore	1	0	0	Los Angeles	1	0	0

Encephalitis, epidemic or lethargic.—Cases: Great Falls, 1.
Pellagra.—Cases: Topeka, 2; Savannah, 6; Montgomery, 1; New Orleans, 1; Los Angeles, 2.
Typhus fever.—Cases: New York, 3

FOREIGN REPORTS

BELGIUM

Vital statistics—1938.—Following are vital statistics for Belgium for the year 1938:

Marriages	61,402
Births	130,604
Deaths	108,682
Deaths under 1 year of age	9,575
Deaths under 1 year of age per 100 live births	7.23
Deaths from:	
Appendicitis	608
Cancer and other malignant tumors	10,325
Cerebral hemorrhage	8,786
Diabetes mellitus	1,711
Diarrhea and enteritis (under 2 years of age)	834
Diarrhea and enteritis (over 2 years of	325
Diphtheria	499
Deaths from—Continued.	
Influenza	1,789
Malaria	9
Measles	231
Nephritis	2,765
Pneumonia	7,535
Poliomyelitis	21
Scarlet fever	127
Senility	11,034
Syphilis	51
Tuberculosis (all forms)	5,744
Typhoid and paratyphoid fever	117
Violence	4,459
Whooping cough	

BERMUDA

Vital statistics—1939.—The following are vital statistics for Bermuda for the year 1939:

Estimated total population	32,853
Marriages	257
Live births	729
Live births per 1,000 population	23.02
Stillbirths	23
Total deaths	321
Deaths per 1,000 population	10.1
Deaths under 1 year of age	47
Deaths under 1 year of age per 1,000 live births	64.4
Deaths from:	
Appendicitis	2
Cancer and other malignant tumors	24
Congenital malformations	49
Deaths from—Continued.	
Diabetes mellitus	
Diarrhea and enteritis (under 2 years of age	
Diarrhea and enteritis (over 2 years of age)	1
Heart disease	74
Nephritis	20
Pneumonia	23
Senility	2
Suicide	2
Syphilis	7
Tetanus	1
Tuberculosis (respiratory system)	6

CANADA

Provinces—Communicable diseases—Weeks ended January 6 and 13, 1940.—During the weeks ended January 6 and 13, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Week ended January 6, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				1	1			2		4
Chickenpox		14	10	163	421	36	23	22	50	739
Diphtheria		1		24	2	15	1	1	2	46
Influenza		101			126				6	233
Measles		4		50	415	20	1	3	16	509
Mumps			1	10	166	5		4	15	201
Pneumonia	3	10			58				9	80
Poliomyelitis					1			1		2
Scarlet fever	8	15	17	101	181	12	13	33	17	397
Trachoma								1		1
Tuberculosis		13	13	40	43	2	4	2		117
Typhoid and paratyphoid fever				18	2			1		21
Whooping cough		25	1	79	97	29	11	14	24	280

Week ended January 13, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis					1		2			3
Chickenpox		25	1	202	507	76	22	18	101	1,132
Diphtheria		1	1	34	3	12	4	1		56
Dysentery					2					2
Influenza		55			37	5			4	101
Measles		3		115	371	22	17	15	21	564
Mumps		2		41	263	14	25	1	2	348
Pneumonia		9			39	1	1		11	61
Poliomyelitis				1	2	1				4
Scarlet fever	2	21	12	110	169	29	10	47	15	415
Trachoma									2	2
Tuberculosis		13	19	25	66	2	1	4		130
Typhoid and paratyphoid fever				7	6			1		14
Whooping cough		16		153	149	72	27	9	24	450

EGYPT

Vital statistics—First and second quarters 1939.—The following table shows the numbers of births and deaths for the first and second quarters of 1939 in all places in Egypt having a health bureau:

	First quarter	Second quarter		First quarter	Second quarter
Number of live births	61,438	52,970	Deaths from—Continued.		
Live births per 1,000 population	49.1	42.3	Dysentery	50	87
Stillbirths	1,124	1,046	Heart disease	1,121	933
Deaths	28,667	42,097	Homicide	235	265
Deaths per 1,000 population	22.9	33.6	Influenza	29	21
Deaths under 2 years of age	6,781	14,596	Malaria	7	5
Deaths under 2 years of age per 1,000 live births	110	276	Measles	95	702
Deaths from:			Nephritis	993	901
Appendicitis	45	54	Plague	2	1
Cancer	254	312	Pneumonia	3,986	4,342
Cerebral hemorrhage, embolism, and cerebral thrombosis	663	683	Scarlet fever	1	----
Diabetes	215	191	Suicide	25	29
Diarrhea and enteritis (under 2 years of age)	4,312	12,966	Syphilis	88	132
Diphtheria	127	94	Tuberculosis (all forms)	629	693
			Typhoid fever	142	199
			Typhus fever	68	147
			Whooping cough	5	14

Estimated population, 1938, 5,006,800.

SWITZERLAND

Communicable diseases—November 1939.—During the month of November 1939, cases of certain communicable diseases were reported in Switzerland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	6	Paratyphoid fever	3
Chickenpox	127	Poliomyelitis	46
Diphtheria	93	Scarlet fever	538
German measles	5	Tuberculosis	225
Influenza	33	Typhoid fever	14
Measles	415	Undulant fever	9
Mumps	97	Whooping cough	299

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of February 23, 1940, pages 342–345. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

Thailand—Noangkhay Province.—During the week ended February 24, 1940, 49 cases of cholera were reported in Noangkhay Province, Thailand.

Plague

Northern Rhodesia—Barotseland.—During the week ended February 24, 1940, 1 fatal case of plague was reported in Barotseland, Northern Rhodesia.

Yellow Fever

French Equatorial Africa—Madingo Kayes.—On March 4, 1940, 1 fatal suspected case of yellow fever was reported in Madingo Kayes, French Equatorial Africa.

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Public Health Reports

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IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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ATTEMPTS TO PRODUCE TUMORS IN RATS BY FEEDING CRUDE WHEAT GERM OIL MADE BY PROLONGED ETHER EXTRACTION [1]

By HAROLD BLUMBERG, *Research Fellow, National Cancer Institute, United States Public Health Service*

In 1937 Rowntree, Lansbury, and Steinberg (*8*) reported the occurrence of malignant intra-abdominal tumors in albino rats that were fed a crude wheat germ oil prepared by ether extraction. This interesting observation was confirmed in a simultaneous publication by Dorrance and Ciccone (*4*), who repeated the work with the use of materials from Rowntree's laboratory at the Philadelphia Institute for Medical Research. Rowntree and his collaborators (*10*) were able to produce these tumors, usually transplantable spindle-cell sarcomas, in more than 90 percent of the animals fed. Rats of the Wistar, Buffalo, and Yale albino strains were used. When daily doses of 1 cc. were administered, either poured over the diet or given directly by dropper, tumors were palpable in from 36 to 268 days. When larger doses were used, as approximately 21 percent of a diet mixture or as daily supplements of 3.5 to 4 cc., tumors were produced in as little as 13 days and in an average of about 54 days. The active fraction was apparently in that portion of the oil which settled out when kept in the refrigerator. Negative results were secured with refined wheat germ oil from ether extraction, expressed oil, naphtha extracted oil, and vitamin E concentrate.

After further investigation, Rowntree, Steinberg, and Brown (*9*) reported that the primary site of tumor origin seemed to be chiefly the intestinal wall in the 109 tumor-bearing animals which they had observed. Also, the crude oil was found to be effective by intraperitoneal injection. It was mentioned that a few sarcomatous tumors were obtained with two other cereal germ oils that were prepared and fed in the same manner as the wheat germ oil.

Several publications have recently appeared in which the above type of results could not be secured with wheat germ oil made by ether extraction. Carruthers (*1*), using the method of wheat germ

[1] From the Department of Immunology and the Department of Biochemistry, School of Hygiene and Public Health, Johns Hopkins University, in cooperation with the National Cancer Institute, U. S. Public Health Service.

oil preparation originally described by Rowntree and coworkers (*10*), fed the oil to 12 Wistar and Sprague Dawley rats as a supplement to the Rowntree stock diet. After 258 days, during most of which time a 1-cc. dosage was used, no tumors were observed. Halter (*6*) fed 12 Wistar rats 1-cc. doses of an ether-extracted wheat germ oil for 12 months, but the results were negative. Evans and Emerson (*5*), using Long-Evans rats and an experimental diet, fed an ether-extracted oil as 30 percent of the diet to 8 rats, but no neoplasms were found after 370 days. Dingemanse and van Eck (*3*) fed 10 Piebald-Wistar animals an ether-extracted oil in 3- to 4-cc. daily doses as a supplement to the ground Rowntree diet. After 267 days no tumors could be found. Working along a somewhat different line, Day, Becker, and McCollum (*2*) investigated the possible role of ether peroxides by dissolving cold pressed wheat germ oil in ether and then aerating so as to double the peroxide content of the oil. Both the treated and untreated oils failed to produce tumors, as determined by feeding 1- to 2-cc. daily supplements for 170 days to piebald rats of the McCollum strain.

The negative character of these publications contrasts with the results of Rowntree and his collaborators. However, it should be noted that the experiments probably did not entirely conform to the latest recommendations of Rowntree (*7*) with respect to strain of rats, stock diet, and preparation of oil. It is regarded as highly advisable to use not quite full-grown rats of a strain of known susceptibility, to adhere to the Rowntree stock diet, and to prepare the oil by a thorough (24 hours or longer) ether extraction of the wheat germ to secure a sufficiently potent product. It is questionable whether all these conditions were satisfied in the negative researches mentioned.

The suggestion or evidence of neoplasm formation associated with the ingestion of an oil derived from the embryo of one of our principal cereal grains is deserving of attention and careful consideration. In the following report is described a series of experiments, begun in the early part of 1938, in which attempts were made to test variable factors and to duplicate the Rowntree experimental conditions as nearly as possible.

EXPERIMENTAL

Experiment 1.—Feeding oil-diet mixture to piebald rats: In this preliminary experiment the animals used were McCollum strain piebald rats, the nutritional behavior of which is well known. The oil was prepared in this laboratory according to the early method described by Rowntree and coworkers (*10*). Although clear when concentrated after filtration of the ether extract, the oil showed a slight sediment after being kept in the refrigerator at about 8° C. A diet mixture was prepared by adding the oil to the McCollum stock diet

in the ratio of 3 liters to 10 kg. of solid food, or approximately 21 percent by weight. The McCollum stock diet is a ground mixture of the following composition: Wheat, 20 parts; maize, 20; rolled oats, 20; flaxseed oil meal, 10; casein (crude), 3.5; whole milk powder, 25; calcium carbonate, 0.5; sodium chloride, 1; ferric citrate, 0.0011; and copper sulfate ($CuSO_4.5H_2O$), 0.0004. A supplement of greens is given twice a week.

At the age of 21 days a group of 10 rats, weighing from 32 to 37 grams and evenly divided as to sex, was started on the oil diet. After 105 days, during which the animals showed fairly good growth, the experiment was terminated. Autopsy of the animals revealed no sign of tumors (see table 1), although Rowntree obtained tumors in 19 to 63 days, or an average of 38 days, with this concentration of oil under his experimental conditions.

Experiment 2.—Feeding oil-diet mixture to albino rats: As a result of the failure to obtain tumors in the preliminary effort, a new series of experiments was designed to extend the work with the benefit of the later conditions which had by then been set forth by Rowntree (7). Two kinds of albino rats were used, the laboratory P. H. strain and the Buffalo strain. The latter were secured from the National Institute of Health, United States Public Health Service,[2] which was the source of Rowntree's Buffalo rats.

The basal diet was an exact copy of the Rowntree stock diet, which is made up of the following: Cracked corn, 60 parts; rolled oats, 15; meat scraps, 14; skimmed milk powder, 10; and sodium chloride, 1. To this mixture was added 1.5 percent of cod-liver oil (Pratt's). Once a week a supplement of carrots (without tops) was given, each rat receiving about one-third of a medium-sized carrot. This diet is somewhat unusual; it is not ground and consequently contains fairly large corn particles, some measuring about $3\times4\times4$ mm.

The wheat germ oil was prepared by a 24-hour continuous flow extraction of the fresh germ (from Russell-Miller Milling Co.) with U. S. P. ether (Mallinkrodt's or Merck's) (7). Before use the ether was usually kept over a saturated aqueous solution of sodium hydroxide (7). It should be noted particularly that, whereas the extracting ether ran quite colorless after about 6 hours, indicating the complete removal of the usual oil, the extraction was continued to the end of the 24 hours, that is, more than three times the period required for the extract to run colorless. The additional extraction of 18 hours was accompanied by some increase in the turbidity of the oil extract. The unfiltered extract was concentrated to small volume by distillation on a water bath. Residual ether was then driven off by heating 1 to 2 hours under vacuum on a water bath and finally on a steam bath. The oil was kept in the dark at room temperature (7), the

[2] Obtained through the kindness of Dr J. W. Thompson, National Cancer Institute, Bethesda, Md.

sediment amounting to about one-fourth the volume after two weeks of settling. Before the oil was used, the sediment was always redispersed by shaking.

A diet mixture was prepared containing approximately 21 percent oil. This was fed to a group of 12 Buffalo rats and 6 P. H. rats, evenly divided as to sex. When started on the experimental diet the animals were 95 to 115 days old, the Buffalo rats weighing 100 to 195 grams and P. H. rats 135 to 205 grams. The Buffalo rats were maintained for 186 days and the P. H. rats for 125 to 145 days. At the end of these periods no neoplasms were found at autopsy. (See table 1.)

TABLE 1.—*Experiments on feeding rats wheat germ oil prepared by ether extraction. No tumors found*

Experiment number	Strain	Number of rats	Starting age (days)	Starting weight (gm.)	Basal diet	Oil dosage	Days on oil
1	McCollum	10	21	32-37	McCollum	21 percent	105
2	Buffalo	12	95–115	100-195	Rowntree copy	21 percent	186
	P. H	6	100	135-205	do	21 percent	125-145
3	Buffalo	6	95–115	125-185	do	3-5 cc. per day	246-440
	P. H	6	100	137-200	do	3-5 cc. per day	125-243
4	Buffalo	10	86–146	140-190	Rowntree lab	3-5 cc. per day	192-224
5	Wistar	5	90–167	143-177	do	4 cc. per day	[1] 190-230

[1] One animal died at 118 days.

Experiment 3.—Feeding oil supplements to albino rats: In this experiment the 24-hour extracted oil was poured over the copy of the Rowntree diet as a daily supplement of 4 cc. per rat. Six Buffalo rats, 95 to 115 days of age and 125 to 185 grams in weight, and six P. H. rats, 100 days of age and 137 to 200 grams in weight, were kept in individual cages and given the oil supplement. The animals of each group were evenly divided as to sex. After about 100 days, during which the males gained weight slightly and the females lost, the dosage of oil was raised to 5 cc. for the larger males and lowered to 3 cc. for the females. These dosages allowed the animals to survive, although with slowly decreasing weights in most cases. The Buffalo rats died or were sacrificed in 246 to 440 days and the P. H. rats in 125 to 243 days. No tumors were found. (See table 1.) By comparison, with a dosage of 3.5 or 4 cc., Rowntree reported tumors in his Buffalo rats in 13 to 99 days (*10*).

It is interesting that, in the one P. H. rat and all six Buffalo rats which survived 243 days or more, hobnail livers were found. Microscopic examination confirmed the finding as diffuse nodular (Laënnec's) cirrhosis, together with fatty infiltration. Observations on this point are being continued.

Experiment 4.—Feeding oil supplements with Philadelphia Institute diet: The stock diet for this experiment, with the exception of the carrots, was kindly furnished by Dr. Rowntree from his own laboratory supply at the Philadelphia Institute for Medical Research. The animals used were 10 Buffalo rats, 3 male and 7 female, the parents of which had been kept on the Rowntree diet since long before mating. The wheat germ oil was the same as in experiment 2, that is, a preparation made by 24 hours of ether extraction.

When the rats were 86 to 146 days old, weighing 140 to 190 grams, they were given daily oil supplements of 5 cc. for the males and 4 cc. for the females. During the latter part of the experiment the dosage sometimes had to be reduced slightly to keep the animals alive. The members of this group, after 192 to 224 days of the oil supplement, showed no tumors. (See table 1.) As has been previously mentioned, Rowntree's Buffalo rats were found to have tumors in 13 to 99 days with an oil dosage of 3.5 or 4 cc. per day.

Experiment 5.—Feeding oil supplements and Philadelphia Institute diet to Philadelphia Institute animals: Through the kindness of Dr. Rowntree a group of five half-grown Wistar rats, born and raised in his own colony, was obtained. These animals, of which three were males and two females, were about 50 days old when received. They were maintained on the diet secured from Rowntree's laboratory until they were 90 to 167 days old, at which times they weighed 143 to 177 grams. Wheat germ oil, prepared by 24-hour extraction, was then poured over the diet as a supplement of 4 cc. per rat per day.

One animal died after 118 days but showed no sign of a tumor. The other animals were maintained for 190 to 230 days on the oil without the appearance of tumors. (See table 1.) Under these conditions Rowntree and coworkers produced tumors in their Wistar rats in 15 to 111 days, or in an average of 54 days (*10*).

DISCUSSION

The report by Rowntree and coworkers of tumor production by feeding a special wheat germ oil has created great interest. Indeed, preparations of oil from wheat germ are used somewhat for therapeutic purposes, but these refined products were stated to be free from tumor-producing action (*10*).

However, failures to confirm the work have left the subject in an uncertain position. In the experiments described in this report no intra-abdominal or other tumors occurred, despite the use of the same strains of rats (Buffalo and Wistar) and the same stock diet. Unfortunately, a sample of the oil from Rowntree's laboratory could not be made available, but the wheat germ oil used was prepared by 24 hours of ether extraction, following the latest directions of Rowntree and coworkers. Some animals were born, raised, and maintained on

diet secured directly from the Rowntree laboratory, and a group of animals was also obtained from the same place. In all cases the experiments were continued well beyond the reported maximum induction period for the dosages used.

In view of these consistently negative results it seems conceivable that some additional factor may be necessary besides a susceptible strain of rats, the particular stock diet, and the specially prepared oil. The induction period sometimes found, such as 13 to 54 days, is in general much shorter than that required by the most potent hydrocarbon carcinogens when injected directly into rats. Furthermore, the induction period shows considerable variation with the same oil dosage, such as from 15 to 111 days with 4-cc. amounts, or 36 to 268 days with 1-cc. amounts. Further investigations are necessary in order to elucidate this problem.

SUMMARY

1. A crude wheat germ oil, prepared by 24 hours of continuous-flow ether extraction, was fed to 18 Buffalo and 12 P. H. strain rats as 21 percent of the diet or as daily supplements of 3 to 5 cc. per rat. The oil administration was maintained for 125 to 440 days, but no tumors were found.

2. A group of 10 Buffalo rats, born and maintained on stock diet from the Philadelphia Institute, received the oil in 3- to 5-cc. daily doses for 192 to 224 days without the appearance of tumors.

3. A group of five Wistar rats, born and raised in the Philadelphia Institute colony, was fed the oil as 4-cc. daily supplements to stock diet secured from the same Institute. The feeding was continued for 190 to 230 days, with the results again negative.

ACKNOWLEDGMENT

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FACTORS INFLUENCING CARCINOGENESIS WITH METHYLCHOLANTHRENE

III. THE EFFECT OF SOLVENTS

By Michael B. Shimkin, *Assistant Surgeon*, and Howard B. Andervont, *Senior Biologist, National Cancer Institute, United States Public Health Service*

Few of the data on the more exact details concerning the carcinogenic properties of even the more common cancer-provoking substances, as recorded in numerous papers from different institutions, are directly comparable. The variability in the species and strain of the experimental animals, in the method of administration, the solvents or other media and the purity of the hydrocarbons, and in the criteria for recording the results contributes to the discrepancies. The desirability of more uniform procedures is well brought out in Fieser's (*1*) attempt to correlate the results obtained throughout the world during the preceding 8 years.

One of the factors which modifies the incidence and the latent period of carcinogenesis with the carcinogenic aromatic polynuclear hydrocarbons is the physical state in which the compounds are administered to the animals. With 1:2:5:6-dibenzanthracene, tumor formation is slower when the chemical is injected as a dispersion in horse serum or adsorbed on charcoal than when it is dissolved in lard (*2*). The dissolved state appears to be the most efficacious in eliciting subcutaneous tumors; it is possible that some constituent in the solvent increases tissue permeability or by some other action renders the compound more active physiologically.

Various solvents for the hydrocarbons have been used, including lard (*2*), sesame oil (*3*), paraffin (*4*), and arachis oil (*5*). Lard is perhaps the most extensively used agent because it is cheap, readily available, and convenient to handle. Data that have been accumulating in this laboratory, however, suggest that the results obtained with lard as a solvent are significantly variable (*6*). Like other animal and plant oils, it is a "complex mixture of variable composition which may undergo changes on storage or on being heated" (*1*).

Since the role of the various factors modifying carcinogenesis with hydrocarbons must be ascertained before quantitative studies can be undertaken, the following investigations on the effect of lard and other solvents upon sarcogenesis with 20-methylcholanthrene were begun in September 1938.

EXPERIMENTAL

The animals used in these experiments were male mice of strain C_3H, raised in this laboratory, and strain A and Y males obtained from the Roscoe B. Jackson Memorial Laboratory. All were kept under identical environmental and dietetic conditions; all were from 2 to 3 months of age at the time of injection, since it has been found that the age of the animals modifies the time of appearance of tumors induced with methylcholanthrene (*7*). The C_3H strain of mice was selected for the majority of experiments because it is very susceptible to the production of sarcoma with carcinogenic hydrocarbons; strain A mice are most susceptible to spontaneous and induced primary lung tumors, and strain Y animals are fairly resistant to the development of both types of tumor (*8*).

The carcinogenic agent employed was synthetic and purified 20-methylcholanthrene, with a melting point of 179.8–180.4° C. (corr.); the same sample was used in all experiments. The concentration of the hydrocarbon in all solvents, unless specifically noted as otherwise, was 0.2 percent, so that 0.25 cc. contained 0.5 mg. of methylcholanthrene.

The solutions, heated to about 40° C., were administered to the animals by a single subcutaneous injection into the right axilla. The mice were examined weekly. As soon as a hard mass which could not be dissipated by pressure was present, the animal was marked and permitted to live until an indubitably growing tumor was observed when it was killed and autopsied. The tumors were recorded weekly, according to the earliest time a hard mass was palpable; the results are presented in 2-week periods in order to conserve space.

The averages of latent periods were computed by multiplying the number of tumors appearing each week by the time in weeks after injection, and dividing the sum by the total number of tumors. Mice dying of causes other than tumor before tumors began to appear in the particular series were subtracted from the original total of the animals injected. In most instances, the mice which are recorded as not having developed tumors were alive and well many weeks after the last sarcoma had appeared in the group.

Experiment 1. Lard as solvent.—Four samples of lard were used as solvents for methylcholanthrene: (1) Lot A, best grade lard obtained commercially, (2) lot B, lard obtained from the same source at another time, (3) lot C, best grade lard bought from another dealer, and (4) lot D, tub lard which was slightly rancid.

The lards were filtered at 37° C., and the filtered portions stored at 4° C. for a few days. They were heated again after the addition of methylcholanthrene, sufficiently to effect solution, and injected into C_3H male mice when cooled to 40° C.

TABLE 1.—*Induction of subcutaneous tumors in C_3H male mice with 0.5 mg. of methylcholanthrene dissolved in 0.25 cc. of lard*

Time in weeks		8	10	12	14	16	18	20	22	24	26	28	30	32	Total number of tumors	Average latent time, in weeks	Standard deviation, in weeks	Standard error of average, in weeks
Lard sample	Number of mice injected	Number of tumors																
A	38	2	5	6	5	3	5	2	3	1	---	2	---	1	35	15 5	5 72	±0 96
B_1	57	8	26	9	6	3	2	1	---	---	---	---	---	---	55	10.8	2 17	±0.29
B_2	19	4	6	5	3	---	---	1	---	---	---	---	---	---	19	10.9	3.04	±0 72
C	23	---	3	3	4	5	3	2	---	1	1	---	---	---	22	14.9	4 24	±0.90
D	25	---	1	4	9	5	5	---	---	---	---	1	---	---	25	14.9	3.18	±0.64

The data are given in table 1. The results with lard lot B have been reported previously (*6*) and include two groups, designated as B1 and B2. The average latent period with lard lots A, C, and D are in close agreement. The observed difference between lard lots B and A, of 4.7 weeks, is 3.6 times the standard error, and the observed difference between lard lots B and C or D, of 4.1 weeks, is 3.8 times the standard error. The differences, therefore, are statistically significant (*9*).

The four groups can be divided into the "rapid" and "slow" lots. Figure 1 shows that when the results with lard lot B, and the combined results with lard lots A, C, and D are plotted separately, two

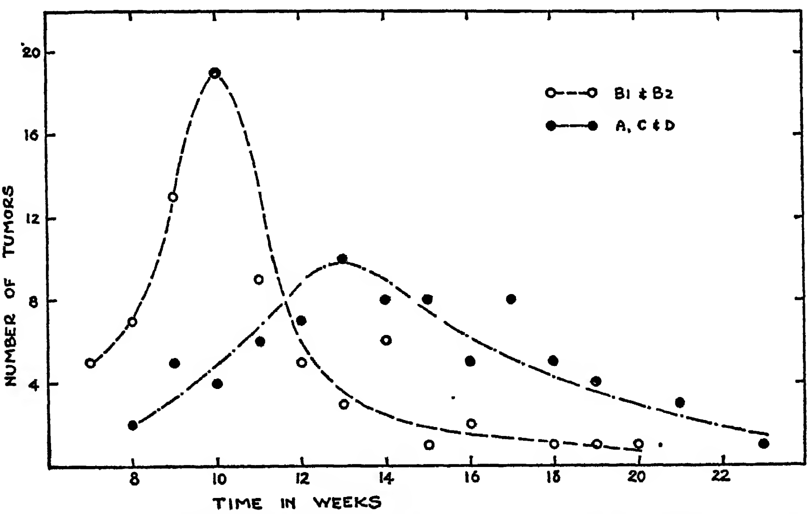

FIGURE 1.—Induction of subcutaneous tumors in C_3H male mice with 0.5 mg. of methylcholanthrene in 0.25 cc. of 4 lots of lard (experiment 1).

fairly regular but different curves are obtained. The slightly rancid lard D gave the same results as the best grade lards A and C.

Experiment 2. Glycerides and esters as solvents.—In an attempt to find a more desirable medium than lard for experiments with carcinogenic hydrocarbons, the following glycerides and esters [1] were used as solvents for methylcholanthrene: (1) Tricaprylin, M. P. 8.3° C., corr., (2) a mixture of equal parts of tricaprylin and trilaurin, M. P. 46.4° C., corr., (3) tricaproin, M. P. —25° C., corr., (4) butyl stearate, and (5) butyl phthalate.

Each C_3H male mouse received 0.5 mg. of the hydrocarbon in 0.25 cc. of the solvent. Another sample of tricaprylin, obtained from another source, and identified as tricaprylin "B," was slightly yellow in color and had a melting point of 8.6°–8.8° C., corr. In this instance, the concentration was 0.5 mg. of methylcholanthrene in 0.2 cc. of the glyceride.

The data are presented in table 2. The influence of the solvent upon carcinogenesis with methylcholanthrene is well illustrated. With tricaprylin tumors arose quickly and regularly within 6 to 14 weeks, an average of 9 weeks; the results were highly reproducible. The latent period was spread to a greater extent with tricaproin and butyl stearate. With butyl phthalate, the average latent period was over twice as long as with tricaprylin, and only 70 percent of the animals developed tumors.

TABLE 2.—*Induction of subcutaneous tumors in C_3H male mice with 0.5 mg. of methylcholanthrene dissolved in various esters*

Time in weeks			6	8	10	12	14	16	18	20	22	24	26	28	Total number of tumors	Average latent time, in weeks
Solvent	Volume	Number of mice injected	Number of tumors													
	cc.															
Tricaprylin	0.25	19	1	8	9	1	---	---	---	---	---	---	---	---	19	8.5
Tricaprylin "B"	2	20	1	6	6	6	1	---	---	---	---	---	---	---	20	9.5
Tricaprylin trilaurin	25	20	---	7	9	1	1	1	1	---	---	---	---	---	20	9.7
Butyl stearate	.25	25	---	6	7	6	3	1	---	---	1	---	---	---	24	10.7
Tricaproin	.25	20	---	2	6	3	2	2	2	1	1	---	---	---	19	12.4
Butyl phthalate	.25	16	---	---	1	---	---	1	1	1	1	3	2	1	11	21.3

None of the solvents used produced abscesses or ulcerations at the site of injection. The solvents were visible in the subcutaneous tissue for at least 12 weeks after injection, and no marked irritative reaction was discernible grossly. Except for butyl phthalate, the solvents were not toxic to mice in 0.5 cc. doses, and none of the control animals (5 to 8 for each compound) receiving the ester alone has developed tumors in 10 to 15 months after injection. Butyl

[1] The use of these compounds was suggested by Professor Louis F. Fieser (1), to whom we are also indebted for furnishing the chemicals.

phthalate was slightly toxic to mice, killing 2 out of 18 animals injected.

Experiment 3. Extracts of mouse tissue as solvents.—Interest in the influence of mouse-tissue extracts as solvents for carcinogenic hydrocarbons was stimulated by the report of Peacock and Beck (*10*) that such extracts [2] inhibited the formation of sarcoma with 3:4-benzpyrene. Morton and Mider (*11*) substantiated the finding; with 0.25 mg. of benzpyrene in 0.25 cc. of sesame oil, 36 tumors occurred in 46 C57 black strain mice, whereas with the same concentration of the hydrocarbon in a petroleum-ether extract of mouse carcasses, 1 tumor appeared in 44 animals.

These observations were apparently at variance with the data at this laboratory. As shown in table 3, the latent periods of carcinogenesis with methylcholanthrene or 1:2:5:6-dibenzanthracene were slightly longer, and the incidence of tumors with the latter hydrocarbon was slightly lower when the compounds were dissolved in ethyl ether extracts of mouse fat than when lard was used as a solvent. The differences, however, were not beyond the variability observed with various lots of lard (experiment 1).

TABLE 3.—*Induction of subcutaneous tumors in mice with 0.25 cc. of mouse fat or lard as solvent for carcinogen*

Time in weeks					8	10	12	14	16	18	20	22	24	Total number of tumors	Average latent time, in weeks
Solvent	Hydrocarbon	Dose in mg	Strain of mouse	Number injected	Number of tumors										
A strain mouse fat	Dibenzanthracene	0.8	C_3H	43	---	1	--	---	8	5	12	4	2	32	18.5
Lard	Dibenzanthracene	0.8	C_3H	15	---	---	2	---	3	---	7	---	3	15	17.8
A strain mouse fat	Methylcholanthrene	0.8	C_3H	20	5	6	7	1	1	---	---	---	---	20	10.2
Lard	Methylcholanthrene	0.8	C_3H	30	15	12	3	---	---	---	---	---	---	80	8.7
Y strain mouse fat	Methylcholanthrene	1.0	Y	10	--	---	---	---	1	3	2	2	---	8	18.8
Lard	Methylcholanthrene	1.0	Y	9	---	---	---	---	1	2	2	---	---	5	18.0

Oberling and his coworkers (*12*) observed no inhibition of tumor formation in rats injected with 3:4-benzpyrene in fat from the same animal, but the technique of extraction of the material is not described.

The problem was reundertaken when it was determined that Peacock's method of extracting the tissues differed from ours. Peacock (*13*) refluxed the dissected mouse fat or eviscerated mouse carcasses in a Sohxlet apparatus, and drove off the ether *in vacuo*. The technique used here was to shake the tissues in cold ethyl ether, and to drive the ether off the filtrate by heating at 37° C.

The possible roles of drying the tissues before extraction, and of extracting the tissues in cold ether (by shaking) as contrasted with hot ether (by refluxing) were therefore investigated. The fat from C_3H mice, dissected from the subcutaneous, omental, and perirenal

[2] Obtained by Sohxlet extraction with ether of dissected mouse fat, the type of ether is not specified.

sites, was divided into two portions, one of which was dried *in vacuo* over phosphorus pentoxide. The two portions were again divided; one dried and one wet fraction were extracted by shaking in cold ethyl ether and the other two fractions by refluxing in a Sohxlet apparatus.

At the same time, fat was obtained from strain A mice and from the F_1 generation of I×C57 black mice, to ascertain whether strain difference would influence the results. These materials were prepared by cold ether extraction of the wet tissues. The effect of various organ extracts, of the liver, brain, abdominal contents including the intestines but excluding the liver, and the chest organs, extracted after drying in a Sohxlet, were also investigated. Extracts of whole mouse carcasses, including the skin and the intestinal tract, were made by shaking the wet tissue in cold ether or by refluxing the dried tissues in a Sohxlet apparatus.

Methylcholanthrene was dissolved in the extracts, 0.5 mg. per 0.25 cc., and the solutions injected into C_3H male mice. The small quantity of liver and brain extracts made necessary the addition of equal portions of mouse fat. As shown in table 4, 6 out of 9 animals injected with the hydrocarbon in fat from strain A mice developed sarcoma, and with the extract of the abdominal organs only 4 tumors were elicited in 12 mice, suggesting that these two solvents inhibited the carcinogenesis. The number of mice employed, however, is insufficient to attach particular significance to the findings; the important fact is that tumors were induced with all the fractions. The differences in results with the extracts are practically within the range of variation observed with different lots of lard.

TABLE 4.—*Induction of subcutaneous tumors in C_3H male mice with 0.5 mg. of methylcholanthrene in 0.25 cc. of various mouse tissue extracts*

Tissue	Extraction: Previous drying	Extraction: Ether	Number of animals	Number of tumors — Time in weeks: 8	10	12	14	16	18	20	22	24	26	28	30	32+	Total number of tumors	Average latent time, in weeks
C_3H fat	−	Cold	20	6	6	2	2	1	1	--	1	--	--	--	--	--	19	10.9
Do	+	do	20	1	6	8	3	2	--	--	--	--	--	--	--	--	20	11.4
Do	−	Warm	10	--	5	3	2	--	--	--	--	--	--	--	--	--	10	11.2
Do	+	do	25	--	5	8	1	2	1	2	1	--	1	--	--	2	23	15.4
A fat	−	Cold	9	2	3	1	--	--	--	--	--	--	--	--	--	--	6	9.0
F_1 fat	−	do	10	1	2	2	1	--	--	2	1	--	1	--	--	--	10	14.9
Whole mouse, C_3H	−	do	12	3	5	4	--	--	--	--	--	--	--	--	--	--	12	9.5
Do	+	Warm	20	1	--	3	3	1	2	1	2	--	1	--	1	--	15	16.7
Abdominal contents, C_3H	+	do	12	--	--	1	1	1	--	--	--	--	--	--	--	1	4	17.9
Liver + fat, C_3H	+	do	20	5	5	6	1	2	--	--	1	--	--	--	--	--	20	11.0
Chest contents C_3H	+	do	9	4	3	1	1	--	--	--	--	--	--	--	--	--	9	10.5
Brain + fat, C_3H	+	do	10	6	4	--	--	--	--	--	--	--	--	--	--	--	10	8.4
Rest of body, C_3H	+	do	10	4	4	1	1	--	--	--	--	--	--	--	--	--	10	9.4

In former studies on the inhibition of tumor formation with animal fat fractions as solvents (*10, 11*), 3:4-benzpyrene was used as the carcinogen. It is more likely, however, that the difference in results is due to the fact that the petroleum-ether used by Morton and Mider (*14*) extracted a different fraction than the ethyl ether employed here.

Experiment 4. Effect of solvents in strain A mice.—Concurrently with the experiments described above, in which C_3H mice were used, small groups of strain A mice were also injected with methylcholanthrene dissolved in various solvents, 0.5 mg. per 0.25 cc. For clarity, they are recorded separately as one experiment.

TABLE 5.—*Induction of subcutaneous tumors in A strain male mice with 0.5 mg. of methylcholanthrene in 0.25 cc. of various solvents*

Time in weeks		8	10	12	14	16	18	20	22	24	26	28	30	Total number of tumors	Average latent time in weeks
Solvent	Number of mice injected	Number of tumors													
Lard (lot B)	18	1	2	4	2	2	1	2	---	1	---	---	---	15	13.2
Tricaprylin	9	1	3	3	---	---	---	---	---	---	---	---	1	8	12.5
Tricaprylin-trilaurin	9	2	3	2	---	---	---	---	---	---	---	---	---	7	9.8
Tricaproin	9	1	---	1	1	1	1	---	---	---	1	---	---	6	15.1
Mouse fat, A strain	20	1	2	2	2	1	1	2	1	---	1	---	---	13	14.7

The observations reported for the C_3H mice are reiterated in table 5 for the strain A animals. Since strain A mice are more resistant to the induction of subcutaneous sarcoma with carcinogenic hydrocarbons (*8*), tumors appeared later and in a lower percentage of mice than in the C_3H animals. Tricaprylin and the tricaprylin-trilaurin mixture were found to accelerate the formation of tumors, and mouse fats retarded their appearance slightly, as compared with the induction of sarcomas with methylcholanthrene dissolved in lard lot B.

Ulceration at the site of injection, for which the strain A mice are noted, was not reduced by the use of the glycerides instead of lard as a solvent for methylcholanthrene; with both, ulceration occurred in 20 to 30 percent of the animals. Tumor formation was neither retarded nor accelerated by the phenomenon.

The induction of primary pulmonary tumors in this group has been recorded elsewhere (*15*). Before 11 weeks after injection, no lung tumors were observed in 16 mice; between 12 and 18 weeks, 11 out of 21 mice had multiple lung tumors, and of the 16 mice killed after 18 weeks, all but one had multiple lung tumors.

DISCUSSION

The investigation demonstrates that the solvent exerts a definite effect upon the latent period and incidence of carcinogenesis with methylcholanthrene injected subcutaneously in the dissolved state into inbred strains of mice. The latent period is very short when tricaprylin is used, and over twice as long when butyl phthalate is the solvent.

It is evident, therefore, that solvents of heterogenous composition, such as lard, will not produce constant results with different lots of the material. Significant variation can be elicited even with relatively large doses of methylcholanthrene (0.5 mg.) in very susceptible animals (C_3H mice). The variations are accentuated when smaller doses of the carcinogen, or carcinogens of weaker potency, are injected into less susceptible animals (*16*).

Another important argument against the use of heterogenous solvents in studies of carcinogenesis with the hydrocarbons is found in the reports of occasional sarcomas obtained at the site of injection of such compounds. Burrows and his coworkers (*17*) describe 12 spindle-cell tumors in 217 rats injected with lard, and Gardner (*18*) reports the production of a sarcoma in one mouse that received repeated injections of sesame oil. Although it is possible that such tumors are of spontaneous origin (*19*), the sarcomas could be the result of nonspecific action or of some undetermined weak carcinogen in the agents. The use of a solvent of known chemical composition obviates the latter possibility.

Tricaprylin, $C_3H_5(OCO(CH_2)_6CH_3)_3$, was the most consistently and most rapidly acting solvent for methylcholanthrene of the five esters tested. It is a colorless, odorless liquid with a melting point of 8–9° C. It dissolves methylcholanthrene rapidly in concentrations of 5 mg. per cc.; 10 mg. per cc. is a supersaturated solution at 37° C. and precipitates at 20° C. The chief disadvantage of tricaprylin as a solvent for polynuclear aromatic hydrocarbons is its present high cost. The experiments reported here have stimulated the development of methods of cheaper large-scale production of the compound (*20*).

SUMMARY

The solvent exerts a definite effect upon the incidence and the latent period of sarcogenesis with 20-methylcholanthrene in inbred strains of mice.

Significant differences are observed in the production of tumors when different lots of lard are used as solvents for methylcholanthrene.

Tricaprylin was found to be a most satisfactory solvent of known chemical composition for studies in carcinogenesis with methylcholanthrene.

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THE PRESERVATION OF THE INFECTIOUS AGENTS OF SOME OF THE RICKETTSIOSES

By NORMAN H. TOPPING, *Passed Assistant Surgeon, National Institute of Health, United States Public Health Service*

In 1935 Flosdorf and Mudd (*1*) described the procedure and apparatus for preservation in "lyophile" form of serum and other biological substances. Since this report there have been many published communications increasing the wide adaptability of the procedure. In 1938 the same two authors described the "cryochem process" (*2*) as an improved method for the preservation of sera, microorganisms, and other substances. The purpose of this paper is to

add another to the already imposing list of materials and substances which lend themselves to satisfactory preservation by either of these two methods, namely, the infectious agents of some of the rickettsioses.

There have been only two satisfactory methods available to the investigator for the maintenance of strains. The first is by constant animal passage, which is exceedingly tedious and expensive and is attended by the constant danger of loss of the strain from secondary infections in the passage animals. The second method is the utilization of some form of tissue culture such as those described by Bengtson (*3a* and *b*), Cox (*4*), and Zinsser (*5*). This second method has disadvantages somewhat similar to the first. The adaptability of this type of material to its preservation by either the "lyophile" or "cryochem" procedures has obvious advantages.

Material has been successfully preserved in the lyophile state from animals or arthropods infected with Rocky Mountain spotted fever, endemic typhus, epidemic typhus, and the rickettsiae recently described by Cox (*R. diaporica*). These four strains represent a wide variety of the rickettsioses and, in general, are representative of the total group.

It has been found that guinea pig serum virus loses its infectivity when subjected to the lyophile state. This is due, perhaps, to changes in pH as suggested by Scherp et al. (*6*) in a report on the influenza virus. Bits of tissue alone, such as strips of spleen in spotted fever, or portions of the brain in epidemic typhus, are also unsatisfactory. Emulsions of organs in saline, too, have immediately lost their infectivity except those from guinea pigs infected with *R. diaporica*, which infection apparently is more resistant to rough handling than the other strains of the rickettsioses.

Sterile skimmed milk has been found to be the best medium in which to suspend infectious material. Briefly, the technique is as follows: The infected animal is anesthetized with ether, opened, blood cultures made, then the organ or material removed. This is macerated in a sterile mortar and about 12 cc. of sterile skimmed milk added. The material is then divided into four equal portions of 3 cc. each and placed in the 5-ml. cryochem or lyophile tubes. The described procedures for preservation are followed. The spleen has been found to be the best material in spotted fever and animals infected with *R. diaporica*, the brain in epidemic typhus, and testicular washings in endemic typhus. The characteristic disease is produced upon testing with no apparent change in virulence as indicated by incubation periods, fatality rates, and scrotal lesions. Animal organs infected with endemic typhus and *R. diaporica* have been preserved for 5 months, Rocky Mountain spotted fever for 1 month, and epidemic typhus for 4 months. Spotted fever virus in ticks has been preserved for 4 months. Tests covering longer periods have not been made.

It has been noted that the contents of an occasional tube, when tested, will fail to infect the animals, while other materials from the same source and preserved at the same time do prove infectious. To overcome this difficulty, it is believed advisable to preserve at least four to eight lots at one time so that duplicates will be available.

When any of the tested material has failed to infect a test animal, it subsequently has been shown that the animal was not usually immunized by the injection of the noninfecting virus. It would seem that the destruction of the infectious agent has also destroyed its antigenicity. However, one test with "tick virus" of Rocky Mountain spotted fever in the lyophile state in milk failed to infect two guinea pigs and these animals later were found to be immune to passage virus.

CONCLUSION

The "lyophile" or "cryochem" technique offers an economical and convenient method for the preservation of rickettsial material.

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HOUSING AND HEALTH RELATIONSHIPS RE-EXAMINED

By Bleecker Marquette, *Fellow, American Public Health Association, Executive Secretary, Cincinnati Public Health Federation, Past President, National Association of Housing Officials*

"Housing" connotes more than the mere condition, design, arrangement, and construction of buildings. It means the conditions under which people carry on their daily life, in their homes and in their neighborhoods. It means the general environment as well as the buildings. Concrete examples of what housing means today are found in the public housing projects, nonexistent a decade ago. These projects are undertaken to provide the kind of environment that favors physical and mental health. They insure essentials in wise site plan-

ning such as low percentage of land occupancy by buildings and the orientation of structures so that the maximum amount of sunshine will be afforded. Provision is made for sufficient window area and such arrangement of windows as will give maximum ventilation; for insulation against heat and cold; arrangement of rooms for maximum privacy; modern toilet and bathing facilities for every dwelling unit; hot as well as cold running water; efficient heating; laundry facilities; fire-resistant construction and safe egress. Thought is given not only to minimizing conditions that are conducive to falls and accidents, but to providing the kind of management that will insure the maintenance of the buildings in a good state of repair. With elimination of overcrowding it is possible to direct the attention of tenants to habits of cleanliness and orderly housekeeping. Projects are planned to include ample room for adult recreation and convenient play space for children.

Viewed in this broad light, few health leaders would question that good housing does promote good health. At the same time, recognized housing leaders do not discount the fact that health is vitally affected by other factors, such as adequate income, proper diet, good medical service, cleanliness, the knowledge and practice of the rules of hygiene, and conditions of employment.

HOUSING AND DISEASE

A clear understanding of the possible relationship between housing and disease may be facilitated by the following statement from a recent paper (*1*) on the influence of overcrowding on the incidence of pneumonia:

> The factors responsible for the production of disease, especially infectious disease, must be considered from three important angles.
>
> (*a*) Predisposing causes which include, among others, age, sex, habits, season, heredity, hygiene, climate, other diseases, poverty, and housing.
> (*b*) Exciting causes—heat, cold, trauma, worry.
> (*c*) Specific causes—micro-organisms, viruses, toxins, etc.
>
> It is likely that these three factors, acting together, set the stage, necessary for the contraction of the disease.

There is much evidence that bad housing and bad environment are predisposing factors in the spread of disease. Examples of specific diseases in some measure attributable to bad housing are discussed in the paragraphs which follow.

Tuberculosis.—Of course, poor housing does not cause tuberculosis. It is a disease caused by a germ and the commonest type (pulmonary) is spread from person to person. Whether or not housing is an important factor in promoting the spread of tuberculosis is debatable, since the relationship is not susceptible of exact measurement. Low income, lack of knowledge and practice of the rules of hygiene, and

unfavorable industrial conditions contribute to the spread of the disease, perhaps even to a greater extent than bad environment. Yet there is strong evidence that environment does play a part.

Emerson (*2*) makes this observation: "In Detroit (1920–29) and New York (1922–30) in this country, and in Glasgow and Edinburgh careful studies have shown that increased prevalence of reported cases or deaths from pulmonary or other forms of tuberculosis is related directly under these conditions (where people are of low economic levels or of mediocre intelligence) to houses unsuitably constructed, and occupied with an excessive ratio of persons to rooms. Among industrial workers in Cincinnati, the United States Public Health Service found that bad housing had a marked effect on the tuberculosis rate which was, in turn, affected by poverty, lack of segregation of advanced sputum cases, and lack of provision for incipient cases."

Since the "white plague" is spread from person to person, room overcrowding is certainly conducive to its spread. One of the aims of the housing movement, even before public housing projects were undertaken, was the elimination of overcrowding.

Groom and Allen (*3*) have shown, from studies in Cincinnati, that tuberculosis mortality varies in direct relation to economic status. The Cincinnati Building Department (*4*) rates residences as to fitness. Allen's studies show high tuberculosis mortality rates for all the major residential areas classified by the building department as distinctly substandard. It is true that these are also low economic areas and there is no doubt that economic status is just as important, or even more so, than the environment. Areas of high tuberculosis mortality are found so constantly to be areas of bad environment that a relationship is indicated in spite of the impossibility of separating the economic from the environmental factors.

A report published in 1938 by the Garden Cities and Town Planning Association of England (*5*) makes certain comparisons of tuberculosis mortality. According to this report the tuberculosis death rate for slum areas of Manchester was 197 per 100,000; for the city of Manchester as a whole, 104; for the Wythenshawe housing development (a public housing project), 72; and for England's 2 most famous garden cities, 38 and 57, respectively. The economic status of families in the Wythenshawe development and in the garden cities is probably higher than that of the slum families, but there is no reason for believing that it is higher than for the city of Manchester as a whole, especially in Wythenshawe whose families are selected because of low income. These data justify a reasonable presumption that satisfactory housing and environment are conducive to lower tuberculosis mortality.

Pneumonia.—Accumulating evidence is establishing a relationship between environment and pneumonia. Recent information compiled by Benjamin (*1*) indicates that pneumonia incidence as well as mortality is excessive in areas of substandard housing and room overcrowding. His studies show a significant correlation between high pneumonia mortality rates and a high degree of room overcrowding in a group of cities.

Benjamin's studies have further demonstrated, by means of a spot map, that the vast majority of pneumonia cases received at the Cincinnati hospitals, public and private, come from the substandard, overcrowded areas of the city where about one-fourth of the population lives.

Rickets.—It has been demonstrated by scientific workers that, while rickets varies with climate and season, its incidence is increased by residence in dark, damp houses and by lack of opportunity for outdoor exercise for young children. Walker (*6*) in Detroit found a correlation between insufficient daylight (less than 0.25 percent of outside light) and the prevalence of rickets. Rickets was rarely found where daylight in the living room was as much as 0.50 percent of outside sunlight.

Infant and maternal mortality.—In the report previously referred to, published by the Garden Cities and Town Planning Association of England (*5*), these facts with regard to infant mortality are brought out. The infant mortality in the slum areas of Manchester was 120 per 1,000 live births; in the city of Manchester as a whole, it was 71; in the Wythenshawe development, 60; and in the 2 garden cities, 33 and 25, respectively. Here again, while the economic factor is not evaluated, there seems to be no reason to believe that, in a housing development like Wythenshawe where tenants are selected because of low income, or in the garden cities where families are of the wage-earner group, the family status should be any better than that of families in the city of Manchester.

Diarrheal diseases take an excessive toll among babies in areas of bad housing and low income. Undoubtedly, low income, diet, and ignorance are vital factors. However, in considering tenement areas, such as those studied in Cincinnati, high incidence of diarrheal disease may be attributed in part to conditions existing because of use of common toilets, many of them broken and out of order, and to the high percentage of unscreened windows in the area. It is significant that Cincinnati's mortality (*3*) from diarrheal diseases is high and its percentage of private indoor toilets is low in comparison with other cities (*7*). Part II of the Cincinnati studies, which concerned mortality by census tracts, states: "There was a very definite localization of high (enteritis) death rates; geographically they centered in the Basin (where the greatest congestion and the worst housing exist,

and where 69.1 percent of the households are without private, indoor toilets); economically, they involved mainly the underprivileged class."

Pediatricians agree that in order to safeguard the health of infants, homes that have adequate sanitary and bathing facilities, including running hot and cold water, light, well-lighted and ventilated rooms with screened windows, and proper heating equipment are requisite, and that lack of these essentials is a menace to the health of babies.

Typhoid fever.—In most of our larger cities, owing to the safeguarding of the water and milk supplies and to sanitary sewage disposal, typhoid fever is no longer a serious problem. It remains a problem, however, in smaller communities where there is no public water supply or where the public water supply is not properly protected from contamination. In these communities the existence of privy vaults is a factor in the spread of typhoid fever.

Disease spread by rats.—It has long been realized by public health administrators that rat bites are much more common than generally supposed. Frequently, in old tenement districts, babies and small children are seriously bitten while sleeping. Rat extermination measures have been necessary on many slum sites cleared for public housing projects. Modern building and housing codes require provisions to minimize the rat menace in new buildings.

The rat has an important role in the direct or indirect transmission of such diseases as plague, typhus fever, tularaemia, trichinosis, rat-bite fever, and Weil's disease. To be sure, rats breed in many types of buildings other than dwellings. Nevertheless, slum elimination and replacement by rat-resistant structures aid in the reduction of this menace.

Rheumatic fever.—Authorities on rheumatic fever point out that this disease is closely associated with poverty and bad environment. The references on this score are abundant in medical literature (*8*).

Mental health and environment.—There seems to be no specific evidence as to the relative prevalence of minor nervous disorders in substandard housing areas as compared with other areas. Nevertheless, conditions existing in slum environment are not such as to promote mental health. Ford (*9*) points out that "Nervous impairment is a disability sometimes occasioned by eye strain, by dark halls and rooms. The insistent noise and confusion almost invariably present in substandard housing areas is bad. Lack of privacy in arrangement of rooms and overcrowding people in rooms is certainly undesirable for the best mental, moral, and spiritual development. The lack of a place for home study adds difficulties for the child in matters of normal mental adjustment."

Facts indicating a relationship between one form of insanity (schizophrenia) and environment have been presented in a paper published recently by the University of Chicago. The study of

mental disease in the city of Chicago, made by Faris (*10*), was based on the records of the Chicago Psychopathic Hospital for 1930 and for 1939. It showed that insanity rates during the year 1930 varied in different parts of the city from 19 to 828 per 100,000 of the population, with an average of 105 for the city as a whole. Faris states, "The high rate areas include the central 'zone of deterioration' where the foreign-born population reside, the 'hobo' and rooming house areas, and the Negro rooming-house and apartment-house areas. The low rates are in the outlying residential areas, including the suburban zone, the areas in which single houses predominate, and the areas of the more expensive apartment houses. Thus it is clearly evident that there is at least a crude association between the high rates of insanity and the parts of the city in which social disorganization is greatest * * *."

Housing and accident hazards.—In the volume "Slums and Housing," Ford (*9*) produces detailed evidence showing that the design, construction, and maintenance of dwellings have a direct bearing on the number of injuries from accidental falls. In the large-scale housing developments undertaken by public and private enterprise today, every effort is made to eliminate these particular hazards.

Ford points to fires as a cause of many accidents, injuries, and even deaths. Home accidents due to dilapidation and fire are also discussed by Britten (*11*). Since one of the aims of planned housing is to require the construction of buildings in such manner as to prevent injuries and deaths due to fire and to provide safe and adequate egress, the relationship between housing and fire as an accident hazard seems clear.

HOUSING AND POSITIVE HEALTH

Neither effective treatment of disease nor freedom from disease constitutes the total objective of the public health movement today. It is not enough to increase the life expectancy. There is no great gain in merely extending life if it can be neither useful nor enjoyable. The goal is to try to make the conditions of life such that the mass of the people may be able to enjoy health, vigor, and usefulness to the full. The following may be listed as some of the necessities for the promotion of health in its most complete sense:

Well balanced and adequate diet.
Adequate medical care, preventive as well as curative.
Exercise and wholesome recreation.
Cleanliness.
Fresh air.
Sunshine.
Rest.
Sleep.

Privacy.
Freedom from unnecessary disturbance of the quiet enjoyment of home life.
Working conditions conducive to health.

This is not a complete or exhaustive list by any means. It is significant, however, that conditions in substandard housing areas of our cities are adverse factors in more than half of these essentials, whereas the conditions that modern housing endeavors to promote are favorable.

Significant studies of housing in relation to health, which touch upon many of the above matters, are being made by the Committee on the Hygiene of Housing of the American Public Health Association. The studies are unique. They approach the subject from a constructive angle with the purpose of aiding housing directors to make the new housing of today promote health. For example, they include the most comprehensive survey of thermal conditions so far made in occupied buildings in this country. They are bringing to light important facts on ceiling heights, illumination, insulation, occupancy limits, environmental influences, recreation areas in relation to housing developments, and similar matters. Many of the findings of these studies are reflected in a report recently published by the Committee (*12*). The report sets forth the "basic health needs that housing should subserve" and outlines these according to fundamental physiological needs, fundamental psychological needs, protection against contagion, and protection against accidents.

It is apparent from the report that the newer concept of housing is concerned with positive health, and, as such, transcends consideration of the mere physical structure and embraces environmental conditions as well. This attitude has, perhaps, best been summed up by Dr. C.-E. A. Winslow, Professor of Public Health, Yale University, at a recent round table discussion held under the auspices of the Milbank Memorial Fund (*13*), at which he said: "In this connection, the round table desires to underline its conviction that the whole philosophy of the modern housing program rests upon the ideal of rebuilding our cities. Mere shelter is not enough, and while the rehabilitation of substandard dwellings and the building of temporary shelters for the unemployed may be useful, it is not housing in the proper sense. Any Government program in this field has fallen woefully short of its objective if it does not create decent conditions of human living in the neighborhood as well as within the walls of the dwelling itself." At this same round table, Dr. George C. Ruhland, Health Commissioner, Washington, D. C., expressed a similar conviction in stating: "It is, I feel, rather fortunate that the health officer's attention is diverted from the altogether too narrow viewpoint of the specific bacterial causes of disease to the broader aspects of environmental influences

such as are involved in the housing projects under discussion here today."

If we are able ever to produce a "slumless America" we shall certainly not eliminate all preventable disease any more than we shall eradicate all delinquency. There are too many other factors involved. Yet the evidence is overwhelming that slum environment acts as a barrier to the efforts of public health authorities to control preventable illness among slum dwellers to the extent possible among the well housed. Insofar as we break down that barrier, we make one more step toward the objective of "health for all the Nation."

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(13) New Light on an Old Problem. Milbank Memorial Fund, 1939.

COURT DECISION ON PUBLIC HEALTH

Tax by public health district upheld.—(Illinois Supreme Court; *People ex rel. Wangelin, County Collector*, v. *Pennsylvania R. Co.*, 23 N.E.2d 38; decided October 13, 1939.) The statutes of Illinois relating to public health districts made it the duty of each board of health to levy annually a special public health tax, not to exceed 1⅓ mills on the dollar, to form a public health fund from which to pay

the salaries of the health officer and employees and the expense of maintenance of the health department. The statutes also provided that each board of health should transmit annually to the county clerk a certificate "setting forth the rate or percentage of such taxes by them levied for the purposes herein provided." The records of the board of health of a particular health district showed that a resolution was adopted levying a special public health tax at the rate of 1⅛ mills "for the purposes provided in" the public health district act, quoting its title, and calling for the preparation by the secretary of a certificate of levy in the form set out in the resolution. A certificate was filed with the county clerk reciting the levy at the rate specified "for the purposes provided in" the public health district act, again quoting its title. Neither the board's minutes nor the certificate of levy showed any total amount required to be raised or any itemized separate purposes with the amounts to be used for each purpose.

In a tax proceeding against the defendant railroad company the levy was sustained against objections that it was void because (1) the taxing district's records did not show the total amount of money to be raised or the specific purposes and amounts for each purpose or whether they were lawful purposes, and (2) the certificate of levy was by rate instead of by amount. In rejecting the defendant's contentions the supreme court in its opinion stated, in part, as follows:

* * * The exclusive purpose for which the levy was made, and shown by the minutes, is the creation of a fund to preserve the public health, specifically authorized by the particular statute under which it was levied, and referred to both in the minutes of the board and in the levy. The taxpayers were fully informed of the legality of the purpose by the record and by the levy. * * *

It is to be noted that the statute under which the levy was made provides for a levy by rate, and that the certificate of levy shall be made in the same way. These provisions were complied with. * * *

DEATHS DURING WEEK ENDED MARCH 9, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Mar. 9, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	9,365	9,688
Average for 3 prior years	9,460	
Total deaths, first 10 weeks of year	96,048	95,246
Deaths under 1 year of age	460	553
Average for 3 prior years	579	
Deaths under 1 year of age, first 10 weeks of year	5,306	5,557
Data from industrial insurance companies:		
Policies in force	66,069,866	67,823,716
Number of death claims	15,103	17,982
Death claims per 1,000 policies in force, annual rate	12.0	13.8
Death claims per 1,000 policies, first 10 weeks of year, annual rate	10.7	10.6

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MARCH 23, 1940

Summary

For the current week, a continuation of the favorable conditions is noted with respect to the 9 important communicable diseases reported to the Public Health Service weekly by telegraph by the State health officers. Each of the diseases included in the following table, with the exception of poliomyelitis, was below the 5-year median, 1935–39, and the accumulated totals for the first 12 weeks of the year (period ended with the current week) are below the 5-year median expectancy for all of the diseases except influenza and poliomyelitis.

The number of cases of influenza dropped from 6,740 for the preceding week to 4,438 for the current week, below the 5-year median of 6,359, while poliomyelitis increased from 19 to 28 cases, much above the median expectancy of 17 cases. The prevalence of poliomyelitis is widely distributed, with only 3 States, California, Kentucky, and Michigan, reporting as many as 3 cases. The number of diphtheria cases, 289, was little more than half the expectancy, while smallpox, with 72 cases, and typhoid fever, with 89 cases, were well below the median figures of 272 and 110, respectively.

For the current week, 1 case of Rocky Mountain spotted fever was reported in Oregon, 2 cases of tularaemia were reported in Maryland, and 1 case each in South Carolina and Mississippi, and 14 cases of endemic typhus fever were reported, 6 in Texas, 4 in Georgia, 3 in Alabama, and 1 in South Carolina.

Telegraphic morbidity reports from State health officers for the week ended March 23, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 23, 1940	Mar. 25, 1939		Mar. 23, 1940	Mar. 25, 1939		Mar. 23, 1940	Mar. 25, 1939		Mar. 23, 1940	Mar. 25, 1939	
NEW ENG.												
Maine	0	0	2	2	54	13	270	18	75	1	0	0
New Hampshire	0	0	0	------	------	------	93	0	8	0	0	0
Vermont	0	1	1	------	------	------	6	24	24	0	0	0
Massachusetts	3	3	3	------	------	------	386	993	782	0	1	4
Rhode Island	0	1	0	------	------	------	143	18	81	0	0	1
Connecticut	4	2	5	7	133	16	68	690	573	0	0	0
MID. ATL.												
New York	19	30	38	[1] 28	[1] 60	[1] 32	479	1,615	2,433	5	0	14
New Jersey	2	4	13	11	12	12	167	46	1,156	1	1	2
Pennsylvania	13	52	40	------	------	------	149	130	952	5	7	6
E. NO. CEN.												
Ohio	4	6	21	14	------	13	9	22	264	0	0	5
Indiana	8	11	12	57	155	49	11	14	84	1	1	2
Illinois	23	24	33	16	326	49	104	20	81	3	1	5
Michigan [2]	2	10	11	1	208	6	289	245	245	5	2	3
Wisconsin	1	0	8	189	969	75	355	769	769	0	1	1
W. NO. CEN.												
Minnesota	0	0	2	2	34	1	214	672	349	1	0	0
Iowa	3	8	8	9	299	12	147	95	95	0	0	1
Missouri	3	10	21	8	144	144	6	18	27	0	0	3
North Dakota	2	2	1	62	414	6	3	64	64	0	0	0
South Dakota	1	0	0	2	40	------	2	170	2	0	0	0
Nebraska	2	3	3	------	7	1	15	165	85	0	1	1
Kansas	6	7	11	14	70	16	628	29	20	0	0	1
SO. ATL.												
Delaware	0	0	0	------	1	1	0	4	8	0	0	0
Maryland [3]	0	2	6	80	19	23	2	736	175	1	0	5
Dist. of Col.	13	3	13	2	3	3	1	68	68	1	1	2
Virginia	11	12	14	501	1,766	------	113	524	427	1	7	7
West Virginia [3]	6	10	10	229	118	118	12	8	20	7	3	4
North Carolina	7	23	12	34	105	105	186	1,313	613	0	5	5
South Carolina [3]	7	14	6	559	1,636	689	15	27	36	1	1	1
Georgia [3]	11	8	10	141	565	565	73	123	0	1	1	1
Florida	8	1	5	10	19	19	178	83	68	1	0	1
E. SO. CEN.												
Kentucky	6	6	8	88	412	100	137	19	151	5	1	7
Tennessee	5	3	8	117	516	184	41	28	75	0	1	7
Alabama [3]	4	17	12	269	2,154	1,330	152	210	210	2	2	5
Mississippi [2]	7	7	6	------	------	------	------	------	------	0	1	0
W. SO. CEN.												
Arkansas	15	8	8	187	1,031	349	13	88	88	1	0	3
Louisiana	8	11	15	14	64	70	0	162	84	2	2	2
Oklahoma	6	10	7	165	466	168	11	191	86	2	0	2
Texas [3]	32	31	43	1,277	1,773	949	800	290	392	1	5	5
MOUNTAIN												
Montana	13	1	1	4	406	7	20	250	73	1	0	0
Idaho	0	0	0	------	------	6	145	82	25	0	0	0
Wyoming	2	0	0	2	2	------	86	53	33	0	0	0
Colorado	9	9	4	23	74	------	19	234	234	0	0	0
New Mexico	0	4	4	11	198	1	14	68	54	1	2	2
Arizona	2	0	2	180	307	102	122	20	29	0	0	0
Utah [3]	2	0	0	15	71	------	718	127	20	0	0	0
PACIFIC												
Washington	1	1	1	------	20	16	1,026	663	203	0	0	1
Oregon [4]	3	2	2	27	63	63	570	68	68	0	0	2
California	15	23	30	181	239	221	260	4,513	984	0	4	4
Total	289	330	504	4,438	14,953	6,359	8,208	15,779	15,779	50	51	159
12 weeks	4,668	6,208	7,301	144,942	100,056	89,257	67,982	152,500	152,500	478	638	1,479

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 23, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 23, 1940	Mar. 25, 1939		Mar. 23, 1940	Mar. 25, 1939		Mar. 23, 1940	Mar. 25, 1939		Mar. 23, 1940	Mar. 25, 1939	
NEW ENG.												
Maine	0	0	0	12	24	17	0	0	0	0	1	2
New Hampshire	0	0	0	1	4	12	0	0	0	0	0	0
Vermont	0	0	0	6	10	20	0	0	0	0	0	0
Massachusetts	0	0	0	141	194	269	0	0	0	0	0	2
Rhode Island	0	0	0	16	12	29	0	0	0	0	0	1
Connecticut	0	0	0	71	108	117	0	0	0	4	0	1
MID. ATL.												
New York	0	0	0	1,190	699	1,056	0	0	0	3	4	8
New Jersey	0	0	0	390	225	177	0	0	0	3	4	1
Pennsylvania	1	0	0	877	417	562	0	0	0	3	14	7
E. NO. CEN.												
Ohio	1	0	1	225	310	367	5	21	3	3	3	2
Indiana	1	0	0	196	182	182	6	37	8	1	0	0
Illinois	0	2	2	833	503	779	2	5	19	4	8	6
Michigan [2]	3	0	0	287	508	508	1	12	12	5	0	2
Wisconsin	1	0	0	134	201	432	0	5	6	1	0	1
W. NO. CEN.												
Minnesota	0	0	0	82	97	180	5	7	18	0	0	1
Iowa	0	0	1	45	145	224	13	22	27	1	1	2
Missouri	0	1	0	47	109	211	8	22	22	3	0	2
North Dakota	0	0	0	16	7	33	1	1	4	1	0	0
South Dakota	0	0	0	18	18	18	4	1	3	1	0	0
Nebraska	0	0	0	15	31	42	0	7	14	0	0	0
Kansas	1	0	0	64	148	148	1	2	23	2	2	0
SO. ATL.												
Delaware	0	0	0	16	9	9	0	0	0	0	0	0
Maryland [1]	0	0	0	39	39	86	0	0	0	1	2	2
Dist. of Col.	0	0	0	37	16	19	0	0	0	1	0	0
Virginia	1	0	0	40	17	30	0	0	0	4	1	1
West Virginia [2]	1	0	0	46	33	52	1	0	0	2	5	5
North Carolina	0	0	0	39	51	39	0	0	0	2	5	3
South Carolina [3]	0	4	0	1	5	5	0	0	0	0	3	2
Georgia [3]	1	0	1	18	7	8	0	1	0	1	4	2
Florida	0	2	0	15	11	6	0	0	0	2	2	1
E. SO. CEN.												
Kentucky	3	0	1	105	90	68	0	2	0	4	1	2
Tennessee	0	0	0	93	37	20	0	3	0	2	1	2
Alabama [3]	0	1	1	9	30	12	1	4	1	2	1	1
Mississippi [2]	0	0	0	2	9	9	0	0	0	6	3	1
W. SO. CEN.												
Arkansas	2	1	0	6	8	10	3	3	1	0	6	1
Louisiana	0	0	0	15	11	13	0	1	1	3	15	9
Oklahoma	2	1	0	20	38	30	1	33	2	1	2	1
Texas [3]	1	0	1	49	89	83	6	29	14	11	14	9
MOUNTAIN												
Montana	2	0	0	21	18	18	0	0	14	1	0	0
Idaho	0	0	0	3	9	15	0	2	2	0	1	1
Wyoming	0	0	0	7	3	20	1	0	0	1	1	0
Colorado	0	0	0	37	20	61	6	2	2	0	1	1
New Mexico	1	0	0	3	28	28	0	0	1	1	0	2
Arizona	2	1	0	13	7	18	0	8	0	0	0	0
Utah [2]	0	0	0	15	21	50	0	1	1	0	0	0
PACIFIC												
Washington	0	0	0	47	45	46	1	1	11	2	0	0
Oregon [4]	1	1	0	18	54	49	2	14	14	4	8	2
California	8	0	0	138	246	240	4	24	14	3	2	2
Total	28	14	17	5,018	4,912	7,410	72	270	272	89	110	110
12 weeks	334	184	248	56,107	63,907	80,773	882	4,520	3,654	916	1,406	1,406

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 23, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended Mar. 23, 1940	Whooping cough, Week ended Mar. 25, 1939
NEW ENG.		
Maine	84	55
New Hampshire	15	0
Vermont	38	32
Massachusetts	104	254
Rhode Island	2	124
Connecticut	23	106
MID. ATL.		
New York	382	545
New Jersey	65	418
Pennsylvania	263	292
E. NO. CEN.		
Ohio	76	146
Indiana	44	46
Illinois	114	281
Michigan [2]	129	153
Wisconsin	84	225
W. NO. CEN.		
Minnesota	22	43
Iowa	1	14
Missouri	27	16
North Dakota	1	9
South Dakota	2	1
Nebraska	4	6
Kansas	39	19
SO. ATL.		
Delaware	14	12
Maryland [2]	253	21
Dist. of Col	14	35
Virginia	40	77
West Virginia [2]	27	26
North Carolina	77	363
SO. ATL.—continued		
South Carolina [3]	26	111
Georgia [3]	14	35
Florida	21	87
E. SO. CEN.		
Kentucky	53	7
Tennessee	29	13
Alabama [3]	4	82
Mississippi [2]		
W. SO. CEN.		
Arkansas	7	34
Louisiana	1	20
Oklahoma	8	1
Texas [3]	255	104
MOUNTAIN		
Montana	2	1
Idaho	11	1
Wyoming	0	1
Colorado	6	96
New Mexico	12	13
Arizona	25	27
Utah [2]	200	40
PACIFIC		
Washington	72	22
Oregon [4]	39	8
California	205	179
Total	2,934	4,201
12 weeks	34,738	50,641

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Mar. 23, 1940, 14 cases as follows: South Carolina, 1; Georgia, 4; Alabama, 3; Texas, 6.
[4] Rocky Mountain spotted fever, week ended Mar. 23, 1940, Oregon, 1 case.

CASES OF VENEREAL DISEASES REPORTED FOR JANUARY 1940

Reports from States

	Syphilis									Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All syphilis					
	Primary and secondary	Early latent [2]	Rate per 10,000 population	Includes late latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population
Alabama [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
Alaska [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
Arizona	35	12	1.12	43	1.03	5	0.12	95	2.27	39	0.93	------	------
Arkansas	95	97	.93	81	.39	12	.06	535	2.58	161	.78	4	0.02
California	------	[4] 485	.78	1,416	2.26	86	.14	2,107	3.37	1,673	2.67	24	.04
Colorado	40	------	.37	48	.45	6	.06	102	.95	66	.61	------	------
Connecticut	25	9	.19	77	.44	16	.09	175	1.00	119	.68	1	.01
Delaware	9	18	1.03	46	1.75	3	.11	201	7.64	42	1.60	------	------
District of Columbia	------	------	------	------	------	------	------	538	8.46	300	4.72	4	.06
Florida	38	429	2.75	1,077	6.34	43	.25	1,756	10.34	119	.70	8	.05
Georgia	------	1,383	4.44	497	1.60	------	------	1,880	6.04	86	.28	5	.02
Hawaii	2	------	.05	39	.96	3	.07	65	1.60	64	1.58	------	------
Idaho	21	------	.42	34	.68	2	.04	61	1.22	9	.18	1	.02
Illinois	100	418	.65	1,370	1.78	66	.08	1,954	2.47	1,132	1.43	21	.03
Indiana	57	27	.24	128	.37	18	.05	344	.99	91	.26	2	.01
Iowa	72	56	.50	119	.46	8	.03	267	1.04	170	.66	1	.01
Kansas	48	62	.59	21	.11	5	.03	191	1.02	116	.62	------	------
Kentucky	184	264	1.35	77	.26	30	.10	668	2.26	384	1.30	1	.01
Louisiana	------	------	------	------	------	------	------	258	1.20	57	.27	3	.01
Maine	9	------	.10	13	.15	1	.01	23	.27	24	.28	------	------
Maryland	83	78	.96	169	1.00	21	.12	469	2.78	145	.86	22	.13
Massachusetts	58	------	.13	[5] 353	.80	20	.05	431	.97	342	.77	------	------
Michigan [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
Minnesota	26	11	.14	167	.63	16	.06	220	.82	172	.64	------	------
Mississippi	------	------	------	------	------	------	------	1,775	8.70	2,244	11.00	------	------
Missouri	------	------	------	------	------	------	------	311	.77	76	.19	------	------
Montana	19	------	.35	10	.18	3	.05	44	.80	16	.29	------	------
Nebraska	27	8	.26	21	.15	4	.03	60	.44	32	.23	------	------
Nevada	2	------	.20	13	1.27	------	------	15	1.47	17	1.67	1	.10
New Hampshire	3	------	.06	6	.12	3	.06	19	.37	14	.27	------	------
New Jersey	115	141	.59	525	1.20	63	.14	905	2.07	251	.58	64	.15
New Mexico [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
New York	283	125	.32	2,116	1.63	141	.11	2,906	2.25	1,200	1.00	16	.01
North Carolina [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
North Dakota	3	------	.04	3	.04	2	.03	17	.24	20	.28	------	------
Ohio	208	152	.53	497	.74	43	.06	900	1.33	355	.53	7	.01
Oklahoma	334	675	3.93	1,400	5.45	189	.74	3,192	12.42	255	.99	------	------
Oregon	38	26	.62	65	.63	12	.12	144	1.39	160	1.54	------	------
Pennsylvania	129	323	.44	126	.12	47	.05	625	.61	76	.07	------	------
Rhode Island	13	------	.19	35	.51	4	.06	88	1.29	37	.54	------	------
South Carolina	------	------	------	------	------	------	------	649	3.43	606	3.20	2	.01
South Dakota	14	------	.20	12	.17	1	.01	42	.61	28	.40	------	------
Tennessee	249	195	1.52	307	1.05	18	.06	776	2.65	315	1.08	10	.03
Texas	290	283	.92	888	1.43	69	.11	2,028	3.25	929	1.49	81	.13
Utah	12	7	.36	22	.42	1	.02	44	.84	45	.86	------	------
Vermont [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
Virginia	------	------	------	------	------	------	------	1,439	5.25	236	.86	------	------
Washington	22	10	.19	28	.17	5	.03	66	.39	119	.71	------	------
West Virginia	------	------	------	------	------	------	------	186	.98	86	.45	------	------
Wisconsin	10	------	.03	43	.15	------	------	53	.18	85	.29	------	------
Wyoming	7	------	.30	8	.34	1	.04	24	1.01	8	.34	------	------
Puerto Rico [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
Virgin Islands [3]	------	------	------	------	------	------	------	------	------	------	------	------	------
Total	2,630	5,294	.77	11,900	1.15	967	.09	28,648	2.40	12,611	1.06	278	.02

See footnotes at end of table.

Reports from cities of 200,000 population or over

	Syphilis									Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All syphilis					
	Primary and secondary	Early latent	Rate per 10,000 population	Includes late latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population
Akron	4	7	0.40	20	0.73	2	0.07	33	1.20	19	0.69	----	----
Atlanta	----	205	6.83	15	.50	----	----	220	7.33	----	----	----	----
Baltimore [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Birmingham	79	50	4.38	101	3.43	14	.48	316	10.74	50	1.70	1	0.03
Boston	19	7	.33	83	1.04	8	.10	148	1.86	148	1.86	----	----
Buffalo	19	----	.32	92	1.53	----	----	121	2.01	42	.70	----	----
Chicago	61	169	.63	882	2.41	36	.10	1,148	3.13	716	1.95	20	.05
Cincinnati [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Cleveland	58	29	.91	125	1.32	7	.07	219	2.32	90	.95	4	.04
Columbus	16	12	.89	20	.64	3	.10	51	1.63	37	1.18	1	.03
Dallas [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Dayton	15	8	1.04	16	.72	----	----	39	1.76	30	1.35	----	----
Denver	----	----	----	----	----	----	----	75	2.49	66	2.19	----	----
Detroit [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Houston [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Indianapolis	16	2	.47	9	.23	1	.03	110	2.85	33	.86	----	----
Jersey City	8	3	.34	13	.40	1	.03	25	.77	7	.22	----	----
Kansas City [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Los Angeles	----	118	.78	385	2.53	16	.11	519	3.41	334	2.20	3	.02
Louisville	----	----	----	----	----	----	----	174	5.13	137	4.04	----	----
Memphis [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Milwaukee	3	----	.05	7	.11	2	.03	12	.19	15	.24	----	----
Minneapolis	7	7	.28	45	.90	2	.04	61	1.22	48	.96	----	----
Newark	8	----	.18	204	4.49	6	.13	218	4.80	80	1.76	16	.35
New Orleans	----	----	----	----	----	----	----	86	1.76	45	.92	5	.10
New York	177	125	.40	1,039	1.39	77	.10	1,641	2.19	843	1.13	16	.02
Oakland	24	----	.77	55	1.76	1	.03	80	2.56	64	2.04	----	----
Omaha	6	----	.27	3	.13	----	----	9	.40	12	.54	----	----
Philadelphia [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Pittsburgh [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Portland [3]	----	----	----	----	----	----	----	----	----	----	----	----	----
Providence	6	----	.23	22	.85	2	.08	45	1.74	20	.77	----	----
Rochester	----	----	----	----	----	----	----	37	1.08	41	1.20	----	----
St. Louis	68	182	2.97	467	5.54	25	.30	742	8.80	193	2.29	5	.06
St. Paul	----	----	----	----	----	----	----	40	1.39	21	.73	----	----
San Antonio	17	26	1.64	144	5.50	15	.57	202	7.72	70	2.68	2	.08
San Francisco	63	----	.91	118	1.71	7	.10	188	2.73	191	2.77	7	.10
Seattle	15	13	.72	70	1.81	4	.10	102	2.64	143	3.69	1	.03
Syracuse	----	2	.09	70	3.11	7	.31	79	3.50	6	.27	----	----
Toledo	4	5	.29	52	1.67	5	.16	66	2.12	22	.71	1	.03
Washington, D. C.	----	----	----	----	----	----	----	538	8.46	300	4.72	4	.06
Total	693	970	.75	4,057	1.82	241	.11	7,344	2.98	3,823	1.55	86	.04

Figures preliminary and subject to correction.
[1] Includes "Not stated" diagnosis.
[2] Duration of infection under 4 years.
[3] No report for current month.
[4] Break-down for primary, secondary, and early latent, not available.
[5] Includes early latent, late, and late latent.

WEEKLY REPORTS FROM CITIES

City reports for week ended March 9, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	162	787	133	7,581	952	2,381	30	397	21	1,198	--------
Current week [1]	90	500	78	1,784	588	1,852	2	342	8	910	--------
Maine:											
Portland	1	------	0	42	2	1	0	0	0	1	19
New Hampshire:											
Concord	0	------	0	0	3	0	0	0	0	0	20
Manchester	0	------	0	11	2	3	0	0	0	0	25
Nashua	0	------	0	36	0	0	0	0	0	0	4
Vermont:											
Barre	0	------	0	0	0	2	0	0	0	0	3
Burlington	0	------	0	0	0	0	0	0	0	2	8
Rutland	0	------	0	0	1	0	0	0	0	0	4
Massachusetts:											
Boston	2	------	0	20	21	51	0	10	0	42	257
Fall River	0	------	1	28	1	0	0	0	0	15	36
Springfield	0	------	0	0	1	11	0	0	0	4	33
Worcester	0	------	0	8	6	5	0	1	0	4	58
Rhode Island:											
Pawtucket	0	------	0	2	0	0	0	0	0	0	13
Providence	0	------	0	129	3	14	0	0	0	9	52
Connecticut:											
Bridgeport	0	1	1	0	4	2	0	3	0	0	45
Hartford	0	1	--------	1	-------	3	0	-------	1	3	--------
New Haven	1	6	0	0	4	2	0	0	0	0	46
New York:											
Buffalo	0	------	1	2	6	10	0	4	0	6	144
New York	19	40	8	48	99	603	0	76	0	71	1,644
Rochester	0	2	0	3	3	11	0	3	0	9	86
Syracuse	0	------	0	0	3	8	0	0	0	2	56
New Jersey:											
Camden	2	------	0	0	2	5	0	1	0	1	28
Newark	0	3	0	110	8	22	0	3	0	22	127
Trenton	1	------	0	0	6	3	0	1	1	6	39
Pennsylvania:											
Philadelphia	3	4	2	9	25	71	0	25	3	37	536
Pittsburgh	1	2	2	1	17	25	0	4	1	10	156
Reading	0	------	0	1	5	0	0	0	0	17	25
Scranton	0	------	--------	1	-------	5	0	-----	0	0	--------
Ohio:											
Cincinnati	1	3	2	0	11	11	0	4	0	11	153
Cleveland	0	80	1	1	18	38	0	13	0	36	216
Columbus	0	2	2	1	9	2	0	3	0	6	123
Toledo	0	1	1	2	1	25	0	7	0	10	82
Indiana:											
Anderson	0	------	0	0	0	0	0	0	0	2	12
Fort Wayne	0	------	1	0	4	2	0	2	0	0	39
Indianapolis	2	------	2	3	7	16	0	5	0	10	114
Muncie	0	------	0	0	2	0	0	0	0	0	20
South Bend	0	------	0	0	0	2	0	0	0	0	15
Terre Haute	0	------	0	0	0	2	0	0	0	0	18
Illinois:											
Alton	0	1	1	0	2	1	0	0	0	1	11
Chicago	8	15	5	26	41	456	0	40	0	40	779
Elgin	0	2	2	0	1	2	0	0	0	0	7
Moline	0	------	0	0	1	3	0	0	0	0	12
Springfield	1	------	0	0	1	4	1	1	0	3	21
Michigan:											
Detroit	1	8	0	22	15	105	0	9	0	45	282
Flint	0	------	0	2	2	12	0	0	0	16	28
Grand Rapids	0	------	1	9	1	17	0	0	1	9	32
Wisconsin:											
Kenosha	0	------	0	1	0	4	0	0	0	0	10
Madison	0	------	0	0	0	4	0	0	0	0	5
Milwaukee	1	------	0	8	10	26	0	3	0	2	119
Racine	0	------	0	1	0	3	0	0	0	0	11
Superior	1	------	0	32	0	0	0	0	0	1	9

[1] Figures for Frederick and Tacoma estimated; reports not received.

City reports for week ended March 9, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	1	172	3	1	0	0	0	0	21
Minneapolis	0	------	4	0	4	18	0	1	0	9	125
St. Paul	0	------	0	3	11	7	0	0	0	17	67
Iowa:											
Cedar Rapids	0	------	------	10	------	3	0	------	0	0	------
Davenport	0	------	------	7	------	4	0	------	0	0	------
Des Moines	0	------	0	5	0	10	3	0	0	0	44
Sioux City	0	------	------	0	------	4	0	------	0	2	------
Waterloo	0	------	------	2	------	3	0	------	0	1	------
Missouri											
Kansas City	0	1	2	2	6	24	0	6	0	1	115
St. Joseph	0	------	0	0	4	2	0	1	0	1	36
St. Louis	4	4	2	1	12	16	0	3	0	16	189
North Dakota:											
Fargo	0	------	0	0	2	4	1	0	0	0	8
Grand Forks	0	------	------	0	------	0	0	------	0	4	------
Minot	0	------	0	4	0	1	0	0	0	0	5
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	0	------
Nebraska:											
Lincoln	0	------	------	1	------	2	0	------	0	0	------
Omaha	1	------	0	8	7	5	0	0	0	1	59
Kansas											
Lawrence	0	------	0	0	1	0	0	0	0	0	3
Topeka	0	1	1	0	1	1	0	0	0	0	14
Wichita	0	2	0	335	3	0	0	0	0	2	21
Delaware:											
Wilmington	0	------	0	0	4	6	0	1	0	3	36
Maryland:											
Baltimore	1	24	4	2	21	28	0	17	0	230	276
Cumberland	0	------	0	0	0	0	0	0	0	0	17
Frederick	------	------	------	------	------	------	------	------	------	------	------
Dist. of Col.:											
Washington	6	------	0	0	12	35	0	9	0	24	171
Virginia											
Lynchburg	1	------	0	0	0	3	0	0	0	7	10
Norfolk	2	34	0	1	6	3	0	1	1	1	31
Richmond	1	------	0	1	0	0	0	0	0	0	50
Roanoke	0	------	0	0	3	2	0	0	0	5	16
West Virginia:											
Charleston	0	2	0	0	1	0	0	0	0	0	15
Huntington	0	------	------	0	------	2	0	------	0	0	------
Wheeling	0	------	0	1	2	2	0	0	0	0	19
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	1	0	0	0	0	0	13
Wilmington	1	------	0	0	3	0	0	0	0	0	18
Winston-Salem	0	1	0	0	1	3	0	0	0	0	12
South Carolina:											
Charleston	1	89	0	0	3	0	0	1	0	0	26
Florence	0	------	0	0	3	0	0	0	0	0	13
Greenville	0	------	0	0	0	1	0	0	0	1	2
Georgia:											
Atlanta	0	27	4	5	2	5	0	5	0	1	89
Brunswick	0	------	0	0	0	0	0	1	0	0	3
Savannah	0	28	1	1	4	1	0	2	0	0	32
Florida:											
Miami	0	11	0	1	1	3	0	1	0	0	44
Tampa	3	4	4	80	1	1	0	2	0	1	34
Kentucky											
Ashland	0	------	0	2	2	0	0	0	0	0	6
Covington	0	------	0	0	4	3	0	2	0	0	16
Lexington	0	------	0	0	1	1	0	2	0	2	18
Louisville	0	33	1	2	12	20	0	3	0	26	73
Tennessee:											
Knoxville	1	3	2	0	3	13	0	1	0	0	33
Memphis	0	8	4	4	10	21	0	8	0	5	100
Nashville	0	------	1	7	6	2	0	0	0	8	51
Alabama:											
Birmingham	1	6	1	0	9	2	0	4	1	2	90
Mobile	0	17	3	1	1	1	0	0	0	0	28
Montgomery	2	4	------	12	------	4	0	------	0	0	------
Arkansas:											
Fort Smith	0	13	------	0	------	1	0	------	0	0	------
Little Rock	0	14	0	0	8	2	0	1	0	0	------

City reports for week ended March 9, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Louisiana:											
Lake Charles	0	------	0	2	2	0	0	0	0	0	5
New Orleans	3	2	1	2	17	22	0	11	0	0	154
Shreveport	0	------	1	0	12	1	0	2	0	0	38
Oklahoma:											
Oklahoma City	0	6	0	0	8	2	0	4	0	0	50
Tulsa	1	------	------	0	------	2	0	------	2	6	------
Texas:											
Dallas	6	6	2	20	4	0	0	5	0	12	80
Fort Worth	0	------	0	0	5	1	0	0	0	16	43
Galveston	1	------	0	12	1	1	0	4	0	1	19
Houston	8	3	1	10	9	3	0	2	0	1	79
San Antonio	1	11	4	57	12	0	0	10	0	5	107
Montana:											
Billings	0	------	0	0	0	2	0	0	0	0	10
Great Falls	0	------	0	0	5	3	0	0	0	0	15
Helena	0	------	0	0	0	2	0	0	0	0	3
Missoula	0	1	0	0	0	0	0	0	0	1	4
Idaho:											
Boise	0	------	0	0	0	0	0	0	0	0	7
Colorado:											
Colorado Springs	0	------	0	1	2	1	0	0	0	0	16
Denver	3	------	2	6	10	5	0	5	0	2	108
Pueblo	0	------	0	5	8	3	0	0	0	1	10
New Mexico:											
Albuquerque	0	------	0	0	1	0	0	3	0	0	10
Utah:											
Salt Lake City	0	------	0	94	1	6	0	1	0	46	34
Washington:											
Seattle	0	------	2	362	6	6	0	3	0	13	100
Spokane	0	------	0	0	3	3	0	1	0	5	28
Tacoma	------	------	------	------	------	------	------	------	------	------	------
Oregon:											
Portland	1	8	0	201	2	4	0	1	0	13	84
Salem	0	------	------	11	------	0	0	------	0	0	------
California:											
Los Angeles	3	65	5	18	10	27	0	14	0	18	339
Sacramento	1	5	1	2	3	2	0	1	0	22	35
San Francisco	5	------	0	3	5	18	0	11	0	12	134

State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Poliomyelitis cases	State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Poliomyelitis cases
Rhode Island:				**Michigan:**			
Providence	1	1	0	Detroit	2	1	0
New York:				**Wisconsin:**			
Buffalo	0	1	0	Superior	0	0	1
New York	1	0	0	**Alabama:**			
Pennsylvania:				Birmingham	0	0	1
Philadelphia	1	0	0	Montgomery	0	0	1
Ohio:				**Louisiana:**			
Cincinnati	1	0	0	Shreveport	0	1	0
Illinois:				**California:**			
Chicago	1	0	0	Los Angeles	0	0	1

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Great Falls, 2; San Francisco, 1.
Pellagra.—Cases: Washington: 1; Savannah, 1; Miami, 1; Tampa, 1; Birmingham, 2; Los Angeles, 1.
Typhus fever.—Cases: Houston, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Weeks ended January 20 and 27, and February 3, 1940.—During the weeks ended January 20 and January 27, and February 3, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Week ended Jan. 20, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				2	1		1			4
Chickenpox		15		194	392	33	46	20	45	745
Diphtheria			1	37	2	11	3	1		55
Influenza		72			48	1			30	151
Measles		1		87	328	77	12	5	11	521
Mumps				34	238	21	81		11	385
Pneumonia		11			24		5		6	46
Poliomyelitis						1				1
Scarlet fever	1	9	7	103	160	18	12	40	15	365
Tuberculosis	1	16	14	68	45	5				149
Typhoid and paratyphoid fever			1	12			1		5	19
Whooping cough		54		96	97	65	25	5	30	372

Week ended Jan. 27, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				6	1					7
Chickenpox		8	1	179	454	79	42	18	55	836
Diphtheria		1	2	28	3	18	4	1		57
Dysentery				1						1
Influenza		48			104	1			16	169
Lethargic encephalitis					1					1
Measles				131	494	109	57	3	36	830
Mumps				45	284	16	1	1	6	353
Pneumonia		6			31	1	1		4	43
Poliomyelitis					2					2
Scarlet fever		9	12	86	172	27	13	31	6	356
Trachoma					1				1	2
Tuberculosis		14	28	75	68	6	14			205
Typhoid and paratyphoid fever				10	2	1		1	2	16
Whooping cough		32	2	137	102	40	60	12	25	410

NOTE.—For the week ended Jan. 27, no cases of the above diseases were reported from Prince Edward Island.

Week ended Feb. 3, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox		15		143	408	32	87	24	35	744
Diphtheria		1	2	21	1	14	7			46
Dysentery				1						1
Influenza		52			622	28			19	721
Measles				132	341	142	53	5	49	722
Mumps				54	320	16	48		5	443
Pneumonia		9			20	1	1		16	47
Poliomyelitis					1					1
Scarlet fever		13	6	140	190	15	10	23	11	408
Trachoma							2		2	4
Tuberculosis	1	23	20	58	54	5		1		162
Typhoid and paratyphoid fever				13	4		1	1		19
Whooping cough		27	43	167	83	15	38	11	7	391

INFLUENZA IN EUROPE

An epidemic of influenza, mild in character, occurred in Great Britain, Germany, and Switzerland during January and February 1940, while no abnormal rise in incidence was reported for Sweden, Norway, Denmark, or the Netherlands, according to the Weekly Epidemiological Record [1] issued by the Health Section of the League of Nations.

In Scotland the peak of the epidemic was apparently reached during the week of February 3. For the 4 weeks ended February 17, pneumonia deaths reported were, respectively, by weeks, 725, 823, 706, and 492, while the number of deaths from influenzal pneumonia were 120, 179, 159, and 139.

In 126 great towns of England and Wales the highest weekly death rate for the year up to February 17 occurred in the week of January 27, while the largest number of deaths from influenza was reported for the week ended February 17.

Influenza mortality in the great towns of England and Wales was higher during the first 7 weeks of 1940 than it was during the corresponding period of 1938 and 1939, but lower than in 1937.

During the first 4 weeks of the year the pneumonia deaths in 57 large towns of Germany (population 24,290,000), excluding Austria, were 500, 638, 695, and 782, while the influenza deaths were 80, 101, 138, and 122, respectively. The general death rate was, successively, 14.7, 15.4, 17.3, and 18.3 per 1,000.

In Switzerland, 2,058 cases of influenza were reported in 14 cantons (including 840 cases at Basel) for the week ended February 10 as compared with 1,347 cases in 13 cantons (712 at Basel) for the preceding week.

LATVIA

Notifiable diseases—October–December 1939.—During the months of October, November, and December 1939, cases of certain notifiable diseases were reported in Latvia as follows:

[1] February 29, 1940.

Disease	October	November	December	Disease	October	November	December
Anthrax	2			Paratyphoid fever	17	17	17
Botulism	2			Poliomyelitis	3	2	5
Cerebrospinal meningitis	5	5	2	Puerperal septicemia	6	8	5
Diphtheria	147	247	206	Scarlet fever	365	507	501
Dysentery		1		Tetanus	3	1	1
Erysipelas	55	58	42	Trachoma	69	34	32
Influenza	43	47	68	Tuberculosis (respiratory system)	148	175	200
Lead poisoning	2	5	1	Typhoid fever	37	43	34
Lethargic encephalitis			1	Typhus fever		1	
Measles	89	214	250	Whooping cough	27	32	52
Mumps	52	82	77				

SWITZERLAND

Communicable diseases—December 1939.—During the month of December 1939, cases of certain communicable diseases were reported in Switzerland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	12	Mumps	130
Chickenpox	189	Poliomyelitis	18
Diphtheria	42	Scarlet fever	405
German measles	11	Tuberculosis	164
Influenza	110	Typhoid fever	3
Malaria	1	Undulant fever	8
Measles	726	Whooping cough	258

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place		Jan. 1–Dec. 31, 1939	January 1940	February 1940—week ended—			
				3	10	17	24
ASIA							
Afghanistan	D	578					
Ceylon: Batticaloa	C	7					
China	C	2,705					
Canton	C	9					
Hong Kong	C	684					
Shanghai	C	427					
Tientsin	C	34					
India	C	123,170					
Bassein	C	14					
Calcutta	C	3,927	99	47	37	44	31
Madras	C	6	1				
Negapatam	C	2					
Rangoon	C	18	6	4	2	2	6
India (French)	C	92	1				
India (Portuguese)	C	17					
Indochina (French)	C	1				1	
Iran	C	435					
Iraq: Basra	C	[1] 1					
Japan: Osaka	C	[2] 1					
Thailand	C	25				[2] 3	49
Bangkok	C	7					

[1] Suspected.

[2] Imported.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE

[C indicates cases; D, deaths]

Place		Jan. 1-Dec. 31, 1939	January 1940	February 1940—week ended— 3	10	17	24
AFRICA							
Algeria: Algiers	C	1					
Belgian Congo	C	58			2		1
British East Africa:							
Kenya	C	4					
Nyasaland	C	2					
Uganda	C	316	7				
Egypt: Asyut Province	C	102	19	5	28	21	26
Madagascar	C	620					
Rhodesia (Northern)	C						1
Senegal: Dakar.[1]							
Tunisia: Tunis	C	1					
Plague-infected rats		5					
Union of South Africa	C	80					
ASIA							
China.							
Fukien Province	D	[2] 753					
Manchuria	D	332					
Dutch East Indies:							
Java:							
Batavia	C	[3] 1					
Batavia Residency	D	[4] 84					
Java and Madura	C	1,549					
India	C	36,489					
Bassein	C	12					1
Calcutta	C	2					
Cochin	C	3				1	
Plague-infected rats		4	3				
Rangoon	C	[5] 8	[3] 1				
Indochina (French)	C	2					1
Thailand:							
Bangkok	C			1			2
Bichitr Province	C	4					
Bisnulok Province	C	35	2	1			
Dhonpuri Province	C			1			
Jayanad Province	C			3			
Kamphaeng Bajr Province	C		25	1	1	1	
Lampang Province	C	1					
Nagara Svarga Province	C		8	5		5	4
Prae Province	C	6					
Sukhodaya Province	C		12	2		1	
Svargalok Province	C	30					
Tak Province	C	10					
EUROPE							
Portugal: Azores Islands	C		2				
SOUTH AMERICA							
Argentina:							
Jujuy Province	C	1					
Mendoza Province	C	1					
Salta Province	C	1	1				
San Luis Province	C	1					
Tucuman Province	C	1					
Bolivia	C	32					
Brazil:							
Alagoas State	C	43					
Bahia State	C	1					
Parahiba State	C	1					
Pernambuco State	C	32					
Sao Paulo State	C	1					
Ecuador:							
Chimborazo Province	C	24					
Riobamba	C	[4] 16					
Guayaquil	C	3					
Plague-infected rats		45					
Loja	C	4					
Puebla Viejo	C	3					

[1] During the week ended Mar. 16, 1940, 1 death from plague (imported) was reported in Dakar, Senegal.
[2] Includes 94 deaths from pneumonic plague.
[3] Imported.
[4] Pneumonic.
[5] Includes 1 imported case.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE—Continued

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January 1940	February 1940—week ended—			
				3	10	17	24
SOUTH AMERICA—continued							
Peru:							
Ancash Department	C	1					
Cajamarca Department	C	10					
Lambayeque Department	C	12					
Libertad Department	C	36					
Lima Department	C	39					
Piura Department	C	35					
Venezuela [6]	C	3					
OCEANIA							
Hawaii Territory:							
Paauhau	C	[7] 1					
Plague-infected rats		54	2	1	1		2

SMALLPOX

Place		Jan. 1–Dec. 31, 1939	January 1940	Feb. 3	Feb. 10	Feb. 17	Feb. 24
AFRICA							
Algeria	C	6					
Angola	C	104					
Belgian Congo	C	1,651	198	136	90	93	
British East Africa	C	688	1				
Dahomey	C	68	16				
Eritrea	C	2					
French Equatorial Africa	C	45					
French Guinea	C	40					
Gold Coast	C	141					
Ivory Coast	C	370					
Morocco	C	10					
Mozambique	C	102					
Nigeria	C	4,620					
Niger Territory	C	134	137				
Portuguese East Africa	C	24					
Portuguese Guinea	C	122					
Rhodesia:							
Northern	C	34					
Southern	C	219	50				
Senegal	C	257	9				
Sierra Leone	C	51					
Sudan (Anglo-Egyptian)	C	552	75	2	20	5	1
Sudan (French)	C	27					
Union of South Africa	C	709					
ASIA							
Arabia	C	1					
Ceylon	C	1					
China	C	1,593	97	21	33		
Chosen	C	155					
India	C	111,230					
India (French)	C	59					
Indochina (French)	C	3,643	130				
Iran	C	87	12				
Iraq	C	91	17	3	3	33	1
Japan	C	229	3				
Straits Settlements	C	1					
Syria	C	1					
Thailand	C	155					
EUROPE							
France	C	4					
Great Britain	C	1	2				
Greece	C	69					
Portugal	C	950	29	4	4	4	1
Spain	C	747	52				
Canary Islands	C	3					
Turkey	C	428					
NORTH AMERICA							
Canada	C	160					
Guatemala	C	9	1				
Mexico	D	1,264		2			
Salvador	C	1					

[6] For the period Dec. 7, 1939, to Jan. 4, 1940, 11 cases of plague with 8 deaths were reported from the interior of Venezuela.

[7] Pneumonic plague; proved fatal.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX—Continued

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January 1940	February 1940—week ended—			
				3	10	17	24
SOUTH AMERICA							
Argentina	C	3					
Bolivia	C	247					
Brazil	C	26					
Colombia	C	2,784	10				
Ecuador	C	8					
Uruguay	C	5					
Venezuela	C	109	18				

TYPHUS FEVER

Place		Jan. 1–Dec. 31, 1939	January 1940	February 1940—week ended— 3	10	17	24
AFRICA							
Algeria	C	1,883	99		[1] 97		
Belgian Congo	C		76	593	156	268	
British East Africa	C	2					
Egypt	C	4,239	180	53	87	104	
Eritrea	C	9					
Libya	C	37					
Morocco	C	901					
Nigeria	C	2					
Portuguese East Africa	C	2					
Southern Rhodesia	C	3					
Swaziland	C	1					
Tunisia	C	6,104					
Union of South Africa	C	1,091	6				
ASIA							
China	C	308	9				
Chosen	C	734					
India	C	17					
Iran	C	86	17				
Iraq	C	49		1	1		
Palestine	C	198	7	4			2
Straits Settlements	C	16					
Sumatra	C	1					
Syria	C	5					
Trans-Jordan	C	19	1	4	4	3	1
EUROPE							
Bulgaria	C	108					
Greece	C	45			1		
Hungary	C	57	12			1	
Irish Free State	C	5					
Latvia	C	3					
Lithuania	C	153					
Poland	C	3,140					
Portugal	C	27					
Rumania	C	942	247	82	82	60	95
Spain	C	62	2				
Turkey	C	471	66				
Yugoslavia	C	404	23				
NORTH AMERICA							
Cuba	C	4					
Guatemala	C	242	16				
Mexico	D	344	2		1		1
Panama Canal Zone	C	3					
SOUTH AMERICA							
Bolivia	C	162					
Chile	C	1,244	8		1		
Peru	C	197					
Venezuela	C	10	1				
OCEANIA							
Australia	C	26					
Hawaii Territory	C	36	1		2		1

[1] For 2 weeks.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

YELLOW FEVER

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January 1940	February 1940—week ended—			
				3	10	17	24
AFRICA							
Cameroon:							
Bafia	C	1					
Nkongsamba	C		1 [1]				
French Equatorial Africa:							
Bangui	C	1 [1]					
Chad—Fort Lamy	C	1					
Fort Archambault	C		1 [1]				
Gabon	D	1					
Madingo Kayes.[2]							
French Guinea	C	2					
Gold Coast	C	2					
Ivory Coast	C	[3] 25	1				
Nigeria	C	[4] 11					
Niger Territory:							
Dosso	C	3					
Konni Circle	C	3					
Tahua	C	[1] 1					
Senegal							
Bambey	C	1					
Dakar	C	[1] 1					
Diourbel	C	6					
Louga	C	[1] 1					
Ziguinchor	C	10					
Sudan (French): Bandiagara	C	1					
Togo (French). Anecho	C	1					
SOUTH AMERICA							
Brazil:							
Amazonas State	D	[5] 1					
Bahia State	D	[5] 1					
Espirito Santo State	D	[6] 104	[5] 28				
Minas Geraes State	D	13					
Para State	D	3					
Rio de Janeiro State	D	3	[5] 1				
Colombia:							
Antioquia Department—							
Caracoli	D	3					
Jordan	D	1					
San Carlos	D	6					
San Luis	D		1	1			
Caldas Department—							
La Pradera	D			1			
Victoria	D					1	

[1] Suspected.
[2] On Mar. 4, 1940, 1 fatal case of suspected yellow fever was reported in Madingo Kayes, French Equatorial Africa.
[3] Includes 8 suspected cases.
[4] Includes 3 suspected cases.
[5] Jungle type.
[6] Includes 8 deaths from the jungle type of yellow fever.

X

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FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

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DIVISION OF SANITARY REPORTS AND STATISTICS

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Public Health Reports

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NEGLECTED OPPORTUNITIES FOR TEAMWORK IN COUNTY HEALTH DEPARTMENT PRACTICE[1]

By J. O. Dean, *Passed Assistant Surgeon,* and Evelyn Flook, *United States Public Health Service*

Perhaps no term appears more frequently in public health parlance than that of "cooperation." Cooperative effort is commonly spoken of as the keynote of success in all public health activities, but, like so many platitudes, statements in regard to cooperation are often uttered without thought of the mechanisms for their effectuation. With this possibility in mind, the day-to-day operations of three representative county health departments were studied with a view to determining the opportunities for coordinate effort and the extent to which such opportunities were embraced. The most impressive disclosure of the study was the fact that occasions for teamwork exist in all branches of health department activities—in supervision, in cooperative performance of the various employees, and in the follow-up service of individual workers.

Probably the foremost opportunity for teamwork among the health department personnel lies in the direction which supervisors exercise over the staff members of an organization. The character of service rendered by a county health department reflects, in large measure, the amount and quality of supervision practiced. Increased proficiency of staff is the ultimate purpose of supervision. To attain this purpose, three devices are essential: Observing each worker's actual job performance, studying records made out by personnel in pursuance of their duties, and encouraging professional advancement among staff members. Adequate supervision, of course, entails more than the employment of these three essentials. However, certain desirable qualities of a supervisor, such as ability to lead and inspire, are of such intangible nature that measurement is difficult. Furthermore, the present study is not an evaluation of supervision as such, but is concerned with its practice only insofar as it offers occasions for measuring

[1] From the Division of Public Health Methods, National Institute of Health, in cooperation with the Division of Domestic Quarantine.

coordinated health department activity. Each of the afore-mentioned supervisory devices presents an opportunity for cooperative effort on the part of the supervisor and subordinate personnel.

The limited extent to which these opportunities were recognized is apparent from the daily records kept by the health officers, who were directly responsible for supervision. According to these reports, it was possible for the administrators of the three health departments to observe the performance of their personnel upon 680 separate occasions. In only 8 of these instances, however, did the record indicate that the health officer was using the occasion for the purpose of obtaining first-hand information on the way personnel conducted their work. It is recognized, of course, that even though no comment was made of his observation, the health officer might well have noticed the techniques, procedures, skill, and performance of his assistant while performing his own duties on a joint call. Nevertheless, the fact remains that he did not consider this evaluation worthy of mention. Presumably, any supervisory attention was incidental to the real reason for the visit, namely, the service which the health officer himself was called upon to render.

Close supervision of nurses would not necessarily be expected of the health officers if provision for part of that administrative duty had been made through other personnel. Nursing supervision, in a restricted sense, was provided for two of the departments. In one county a consultation service was furnished by the nursing staff of the State health department, but, according to the records of the local nurses, a consultant nurse visited this department only four times in a 12-month period. The visits averaged less than a day in length, and the time was largely spent in office conferences with local nurses and the health officer. Apparently, little attention was given to field observations. No home visits with the consultant nurse were recorded. Opportunities for seeing group or clinic services conducted were presented at only one of the four visits. Accordingly, these visits initiated by the State health department were advisory in nature, and did not provide that first-hand observation so important to improvement of the worker's technique. In another county a senior nurse gave part of her time to overseeing the work of her colleagues; however, for the most part, she had to limit such activities to clinic and other group services. Therefore, in actual practice very little observation was made of the working habits of staff members. As a consequence, only a meager amount of coordinated service could successfully result.

The impossibility of complete supervision without records constitutes one of the fundamental reasons for maintaining them. Detection and correction of such defects as maldistribution of service among the population, improper selection of cases for return visits, or delinquency of patients in clinic attendance rest upon a practice of using

records as an aid to supervision. According to the data at hand, however, by actual performance, records were examined only 92 times for administrative reasons. In 86 of the instances this was necessitated by the preparation of periodic reports to State health departments, a duty that has no immediate bearing on the supervision of personnel by the local health officer.

In much the same manner that treatment complements diagnosis in the field of medical care, staff education complements observation and record study to form the complete picture of supervision, which, concomitantly, encourages cooperation on the part of health department personnel; without corrective measures the effort expended on observation and record study is largely wasted. In-service training activities such as conferences, classes, or study assignments offer perhaps the best opportunity for staff education. Records of conferences provide some data for judging the extent to which such corrective and educational methods may have been employed. In the course of a year 665 occasions were recorded wherein health officers conferred with one or more persons under their direction. The purposes of the conferences were as follows:

Receiving requests for assistance in handling situations	88
Planning, outlining, and discussing program	272
Giving directions and instructions	134
Conferring about vacations, sick leave, resignations, employment, etc	66
Conferring about supplies and equipment	29
Discussing practices or techniques, reviewing knowledge content	20
Determining or discussing policy	14
Miscellaneous	42
	665

Conferences generally included only one or two staff workers, a greater number than this being present on less than 50 occasions. With few exceptions the conferences were informal and brief in character, conducted as exigency demanded. While one cannot eliminate learning from any situation in which two persons exchange ideas, it is a matter for conjecture as to how much improvement of service resulted from contacts which often involved only the assigning of tasks, giving of orders, or receiving of instructions. Other conferences which seem to be rather remote from staff education as to purpose are those held for consideration of vacations, sick leave, resignations, employment, and the like; those devoted to discussions of supplies and equipment; and those where requests were made by the subordinate employee for assistance in handling specific situations. Conferences held for "discussing the program" might well have expanded the worker's horizon if methods suggested for solving problems immediately at hand provided experience for handling similar situations in the future. Perhaps the sessions used for

determining or discussing the department's policy, considering practices or techniques, reviewing knowledge content, and planning or outlining a program offered the best basis for staff education. All three health officers recognized and, in a restricted manner, took advantage of these opportunities. In one county nurses were assigned topics for study immediately related to forthcoming activities, and were invited to discuss these subjects at conferences of the nursing staff. At these sessions the health officer and nurses gave serious consideration to ways and means of improving in-service training activities.

From the foregoing statements it may be seen that certain corrective and educational features of supervision were encompassed by the administrative activities of the health officers. Generally speaking, however, they must have been instituted rather arbitrarily, inasmuch as little direct observation or review of behavior patterns was used as a guide. In all probability, much more fruitful teamwork between the health officer and his staff would have resulted from conferences based upon actual weaknesses of personnel observed by the health officer or discovered by him in perusal of records kept by his staff.

While effective coordination of health department services begins at the top, it is not restricted to the health officer's administrative technique. Additional opportunities for cooperation are found at the staff's operating level through teamwork among the various employees, through coordination of field and clinic activities, and through prompt follow-up of conditions reported by private physicians or other community leaders. It might be assumed that in any organization each employee recognizes in his coworkers special abilities and training for coping with particular problems. Equally important is his recognition of a responsibility for consulting the person best qualified for meeting a specific situation when the individual responsible for a given service finds his own knowledge inadequate. Certainly, in view of these circumstances, numerous occasions for enlisting the aid of coworkers must have occurred in the course of serving 32,179 persons [2] from the 3 study counties. That the value of such procedure was not thoroughly appreciated is apparent when recipients of health department service are analyzed to show number and sequence of contacts by different types of health workers. For example, while 40 percent of the recipients of health department service were contacted by more than one staff member, nearly one-half of these were seen simultaneously by the nurse and dentist or nurse and health officer in connection with a prearranged school program, and not because the first worker considered it advisable to

[2] This number exceeds that reported by Mountin, Joseph W., and Flook, Evelyn: The scope of personal service rendered by 3 representative health departments. The Health Officer (November 1939). The present number (32,179) includes all persons served by special part-time relief personnel, as well as those served by regular health department personnel.

call in the second. An additional 15 percent of those served by multiple workers were contacted in the same manner at other places. Consequently, the type of cooperation under discussion at this time could not have been directly employed in service to more than a small proportion of health department clients. Actually, however, only in rare instances did the records indicate that such cooperation took place. Intervals between visits were such as to argue that the contacts were unrelated to visits by other workers.

Teamwork among health department employees might have been exercised without being apparent from the records of individual clients considered separately. As a matter of fact, the maximum opportunity for cooperative service probably lies in the solving of health problems which affect the entire family. Optimum cooperation exists when the first worker (for example, the public health nurse) visits a home for one particular purpose and during that visit observes and reports another condition which calls for the services of a second staff member (possibly the sanitation officer). The second worker, in turn, promptly investigates the reported situation and performs the service indicated.

Data at hand suggest that this method of coordinating family services was seldom pursued; only 4 percent of all families listed as recipient of health department services were visited in the home by more than one member of the health department staff. Even if every one of these households had represented an instance of referred service, the maximum volume could not be considered of great magnitude. Upon further examination of the conditions prevailing in these homes, it is noted that services rendered by several health department employees to 42 percent of this small group of families were independent of each other and that visits to 25 percent were made coincidentally by two workers. That a majority of the visits were unrelated was determined both by the type of service recorded and by the dates on which visits were made. Obviously, there could be no association between a visit made by the sanitation officer for inspection of premises in October and a post-natal nursing visit made in May. Visits made concurrently by two or more workers do represent a certain form of cooperation, for they were usually the outgrowth of a prearranged program such as medical care in one county, or the milk-control program or tuberculin-testing activities in another. At the same time, this combined type of service obviates the probability that aid or advice concerning a specific problem was sought individually by or from either employee.

Upon the relatively few occasions when expert attention of coworkers was solicited, the problem for which consultation was held was usually one included in a definite program. Thus an organized plan for medical care was responsible for over half of the referred

service which was recorded in one county. The nurse and county physician (assistant health officer) were the two staff members usually involved in administration of the medical care program, and these two workers called upon each other for assistance more often than did any other two health department employees. Even in the counties where no medical care was concerned there appeared to be more teamwork between the health officer and nurse than between any other types of personnel. When a second worker was directed to the home by the first health department visitor, it was almost without exception in reference to the problem already under consideration, and not because a new and separate need of the family had been discovered.

Communicable disease control was given the attention of several staff members more frequently than was any other single problem. Ninety-one of the 211 families receiving referred health department services were visited in connection with a situation of transmissible illness. The aid of associates was seldom sought for conditions other than diphtheria, scarlet and typhoid fevers, and diseases of rather rare occurrence such as Rocky Mountain spotted fever, infantile paralysis, smallpox, and meningitis. The 91 households which received cooperative service represent only a small fraction of the 2,000-odd families attended by health department personnel for communicable disease. The most complete utilization of all health department forces took place in the handling of typhoid fever situations. More than four-fifths of the families supervised by the three health departments because of typhoid fever were visited by two or more staff members working cooperatively for the good of the household and community. When the health officer made the initial investigation, diagnosis of the case was usually followed by a visit from the sanitation officer who investigated the water supply and the condition of excreta disposal facilities. The nurse visited the home for purposes of instructing the family in patient care and contact protection. Less than one-fifth of the families supervised for either diphtheria or scarlet fever were served by a second worker following a visit from the first. Furthermore, in many instances the initiator of service merely quarantined a family and, after a designated period, a coworker went to the home for no other purpose than to terminate quarantine. Under such a system no more was gained from the presence of two workers in that home than if the original person had made the second call.

In addition to the specialized knowledge and abilities of their coworkers, health department employees have access to certain laboratory facilities which are of invaluable aid in determining questionable diagnoses or in confirming a patient's complete recovery

from a transmissible infection. Certainly a truly cooperative program includes the utilization of all such available facilities.

In the counties cited as examples of general health department practice, the number of culture specimens recommended by the Committee on Administrative Practice [3] were collected for only 35 percent of all diphtheria cases and 14 percent of all typhoid fever cases supervised. Here, then, is further unexploited opportunity for cooperative enterprise on the part of a county health organization.

Promptness with which the health department assumes charge of a communicable disease situation [4] is still another measure of the extent to which cooperative activity permeates the program, inasmuch as effectiveness of control is largely dependent upon the punctuality with which the situation is investigated. Records of the study counties suggest that frequently the delay in assuming charge was sufficient to nullify the value of much of the effort expended. Initial visits to approximately one-fourth of this selected group of situations were not made until at least a week after date of onset. The median interval between onset and first health department visit was four days. A lapse of at least six days was frequent, and more than a week's delay in visiting even the more serious communicable disease situations was not uncommon. Greater delay occurred in reaching families with typhoid fever than in visiting those with diphtheria or scarlet fever. In protest against such procrastination, the Appraisal Form for Rural Health Work,[5] at the time of this survey, allowed credit for case investigation only when such activity took place within 24 hours of reporting. It is highly probable, of course, that the delay described was due to tardy reporting of transmissible illnesses rather than to negligence of the health department. Regardless of the cause, lack of harmony is indicated in the actual operation of procedures designed to control communicable illnesses.

In the foregoing discussion, attention has been drawn to many occasions for teamwork among the various health department employees in their daily job performance. When summated, these opportunities may be described as coordination of activities through supervision of the health officer and cooperation of effort among his subordinate personnel. Complete unification of the health department program cannot be attained, however, until the concept of coordinate service is applied by each staff member to his own individual work.

[3] The Committee on Administrative Practice. Appraisal Form for Rural Health Work. American Public Health Association, New York, 1932.

[4] A situation comprises all of the communicable disease conditions existing in a household and receiving the services of the health department for any one continuous period. One disease or several diseases may constitute a situation, and one person or several persons may be involved. In effect, a situation begins and ends, respectively, with the institution and termination of restrictive and supervisory measures used by the health department in an effort to control communicable disease in a household.

[5] See footnote 3.

The extent to which single workers of these three counties organized their own services by regarding the family rather than the individual as the center of consideration has already been analyzed by Bean and Brockett.[6] Their study was based upon the functioning of the generalized nursing program which is designed to focus attention upon problems of the entire household, thus causing the family to become the unit of service. Little evidence was found to support the claim that the general nurse renders a complete family service. Even when all services furnished a family during the period of an entire year were considered, less than half of the family population were given attention. In one-third of the families only one person was served at any visit, and little thought appeared to have been given to the development of constructive programs for the family as a whole.

Many administrators believe that the use of case records greatly facilitates the coordination of service by individual health department employees. Supposedly, case records constitute a device by which the nurse can plan a daily program; furthermore, they guide her in selection of items for attention on subsequent visits. Failure to use the case records as a basis for selecting cases most in need of return visits is apparent from the data. Many of the individuals for whom case records were prepared received no return visits. At the same time, subsequent visits were made not infrequently to those without case records. Hence, the existence of such a form exerted no outstanding influence upon selection of cases to be visited during the day.

Derryberry [7] cites further evidence of the absence of conscious selection of cases for repeat visits in two of the counties under consideration. Briefly, he reports:

> The data do not bear out the assumption that the items now used on case records serve to remind the nurses of unsatisfactory conditions, and thereby to influence them to return and try again. * * * They do not show any vital association between unsatisfactory conditions in regard to the items listed on the records and repeat visits by the nurse. In making their selection of cases for revisits, the nurses are apparently guided but little by their recorded adverse judgments on conditions which it is their business to observe, inquire into, and improve. The few unsatisfactory items that do appear to influence the nurses are by no means commensurate with the amount of time spent on setting down the details of each case.

Further indication that records kept by the nurses were not utilized for coordinating their work is noted in another of Derryberry's reports.[8] In one county 25 percent and in another, 40 percent of the items recorded as unsatisfactory on the first call were given no grading

[6] Bean, Helen, and Brockett, George S.: The family as a unit for nursing service. Pub. Health Rep., 52: 1923 (Dec. 31, 1937).

[7] Derryberry, Mayhew: Do case records guide the nursing service? Pub. Health Rep., 54: 66 (Jan. 20, 1939).

[8] Derryberry, Mayhew: Nursing accomplishments as revealed by case records. Pub. Health Rep., 54: 2035 (Nov. 17, 1939).

whatever on subsequent visits. Whether the nurses did not observe these items on repeat visits, or whether they forgot them when making out their records is unknown. In either event, the workers failed to take full advantage of the aid which records are designed to give. If the indicated conditions were not observed, the opportunity for coordination of services was ignored. If, on the other hand, observance was not recorded, the absence of appropriate entries on the form limits the usefulness of the record as a guide to future work.

SUMMARY AND CONCLUSIONS

That there is a direct relationship between economy and effectiveness of health department practices and the degree to which activities of the various staff members are coordinated is self-evident. Nevertheless, a study of the daily activities of three representative rural county health departments reveals that specific occasions for achieving a well-unified service are not commonly recognized. Indexes used for measuring the extent of coordinated activity were as follows: (1) Type of supervision exercised by the health officer over subordinate members of his staff, as expressed in terms of observation of actual job performance, study of service records made out by personnel, and encouragement of professional advancement among staff members; (2) amount of teamwork in which the various workers participated for the control of specific problems, or relationship of visits by several workers to one family; (3) extent to which field and clinic activities were coordinated, (4) promptness with which conditions reported by private physicians were followed up by health department personnel; (5) degree to which the family rather than the individual was recognized as the unit of service; and (6) proportion of case record entries which influenced future service of the worker.

Records kept for the period of 1 year by the personnel attached to the three afore-mentioned health units suggest that innumerable opportunities for teamwork among the staff existed in the course of their routine duties. These same records also indicate, however, that advantage was taken of only a small proportion of these opportunities. Failure to make use of these situations may be ascribed to circumstances such as these: Supervisory activities appear to have been instituted arbitrarily instead of evolving from actual weaknesses of personnel; staff workers apparently pursued individual programs which resulted in isolated rather than integrated performance; the family as a whole was not recognized as the basis of service; and little study was made of records of past service, with a view to guiding future work.

In the light of these disclosures, it appears that closer supervision should be exercised by administrators over the daily performance of individual workers and that the supervisory function of administra-

tion should encourage the different members of local health department staffs to seek the aid and advice of their colleagues upon more numerous occasions. Increased cooperation between private physicians and the health department in establishing control over households with communicable disease is necessary to effective handling of this specific problem. Finally, employees working alone must look beyond the problem immediately at hand and recognize the needs of the family as a unit, making sure that the services rendered represent an outgrowth of findings recorded from previous visits.

STUDIES OF SEWAGE PURIFICATION [1]

XII. METABOLISM OF GLUCOSE BY ACTIVATED SLUDGE

By C. C. Ruchhoft, *Principal Chemist*, J. F. Kachmar, *Junior Chemist*, and O. R. Placak, *Junior Chemist, United States Public Health Service, Stream Pollution Investigations Station, Cincinnati, Ohio*

The factors involved in the removal of glucose from substrates by activated sludge were studied in the previous paper of this series (*1*). It was shown that the rate of glucose removal was a function of the quantity of activated sludge present. Factors influencing the rate of glucose removal and indicating the biochemical nature of the reaction were the necessity for the maintenance of dissolved oxygen and the control of both temperature and pH within common biological ranges. The fact that supplemental feeding of organic nitrogen promoted glucose removal, that starvation by prolonged aeration without food destroyed glucose removal ability, and that a sludge could be acclimated by repeated glucose feeding indicated further the biochemical character of the glucose removal reaction. Ingols' (*2*) experiments also favor the view that the removal of glucose from solution is a biological reaction. The review in the preceding paper (*1*) indicated the lack of knowledge of the glucose removal mechanism and the desirability of such knowledge for the better understanding and operation of the activated sludge process.

It is the purpose of this paper to present the results of a study of glucose metabolism by activated sludge. While bacterial metabolism of glucose is generally considered to be largely dissimilation, Clifton and Logan (*3*) have shown that suspensions and cultures of *Escherichia coli* also assimilate glucose. Both the dissimilative and assimilative mechanisms of glucose metabolism by activated sludge have been considered. The quantities of oxygen utilized, percentages of glucose oxidized, and respiratory quotients during glucose removal have been determined. A search for dissimilation products of glucose has been made and the assimilation of a considerable quantity of the glucose

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[1] Also published in the March 1940 issue of the Sewage Works Journal.

removed from solution has been demonstrated. This assimilative mechanism of the bacterial flocs of activated sludge is suggested as an explanation for the large increase in quantity of activated sludge produced as a result of carbohydrate feeding, which is often followed by sludge bulking.

OXYGEN RELATIONSHIPS DURING GLUCOSE REMOVAL BY ACTIVATED SLUDGE

Oxygen utilization during glucose removal by activated sludge was determined by the method described in an earlier paper (*4*). The quantities of oxygen used in the glucose-fed sludge and in the control sludge were determined simultaneously during aeration. The quantity of oxygen utilized as a result of the attack and removal of glucose is taken as the increment of oxygen absorbed by the glucose-fed sludge. All of the experiments to be described were carried out in 20° C. incubators and the analytical methods employed were the same as in the previous paper (*1*). The oxygen utilization and glucose removal data for a typical experiment in which glucose alone was fed are given in table 1. The quantities of oxygen used by the glucose-fed and

TABLE 1.—*Removal and oxidation of glucose by activated sludge*

Aeration time, hours	Oxygen utilized, p. p. m.			Glucose removed from solution by sludge, p. p. m.	O_2 required (p. p. m.) for complete oxidation of glucose removed	Percentage oxidation of glucose removed	Maximum possible percentage oxidation of glucose by all O_2 used in fed sludge
	Sludge plus glucose	Sludge control	As a result of glucose added				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
½	26.2	9 0	17.2	172 0	194.0	8.9	13.5
1	51.8	17.5	34.3	306.0	326.0	10 5	15.87
1½	62.4	25.0	37.4	406 0	433.0	8 6	14.41
2	85.7	32.6	53.7	471 0	503.0	11.7	17.03
3	103 0	42.8	60.2	660 0	704.0	8.6	14.63
5	125 0	50 0	75.0	895.0	955.0	7.9	13.08
23	247.7	139.9	107.8	896.0	956.0	11.3	25.91

Derivation of data:
(3)=(1)−(2).
(5)=(4)×1.067.
(6)=(3)×100÷(5).
(7)=(1)×100÷(5).

control sludges are given in columns 1 and 2, respectively. The increments of oxygen used in the attack upon glucose are given in column 3 and the quantities of glucose removed from solution in column 4. The quantities of oxygen that would have been required for the complete combustion of the glucose removed were calculated. These values, which are the "L values" or total carbonaceous oxygen demands of the glucose that had been removed at each observation time, are given in column 5. The percentages of these total carbonaceous oxygen demand values of glucose removed which had been

satisfied (oxidized) were calculated and are given in column 6. The maximum possible percentage of oxidation of glucose, if all of the oxygen utilized by the fed sludge mixtures is attributed to glucose oxidation, is given in column 7. These data indicate that only about 11.3 percent of the glucose was oxidized during the 23-hour aeration period in which 896 p. p. m. of glucose were removed from solution. It is noted also that during this removal reaction the fraction of glucose oxidized changes but slightly so that errors in the determinations somewhat obscure the trend.

In some experiments the plant activated sludge was acclimated to glucose by dosing the sludge daily in the laboratory for a few days with sewage containing 500 p. p. m. of glucose. When such sludge was dosed with 1,000 p. p. m. of glucose the sugar was largely removed from solution in the first 1½-hour aeration period. It may be assumed that the low oxidation of glucose found in the experiment in which glucose only was fed was the result of insufficient nitrogen for metabolic uses of the cell. Carpenter (*5*) has recently shown that the ratio of glucose to nonprotein nitrogen used during glucose utilization by the coliform group was about 48 to 1. Assuming that this ratio would also apply to the organisms in activated sludge, about 100 p. p. m. of glycine as a nonprotein source of nitrogen were added with 1,000 p. p. m. of glucose in a number of experiments. The oxygen utilization and glucose removal data for one of these experiments are given in table 2. The percentage oxidation data in tables 1 and 2 are similar. However, the trend toward slightly higher percentage oxidation with increasing time is more evident in table 2 where this percentage increased from 7.0 at 1½ hours to 16.8 in 24 hours. Continuation of the sludge aeration to 40 hours in this experiment did not increase appreciably the percentage of glucose

TABLE 2.—*Removal and oxidation of glucose by activated sludge*

[1,100 p. p. m. of glucose fed to a plant sludge that had been glucose-acclimated]

Aeration time, hours	Oxygen utilized, p. p. m.			Glucose removed from solution by sludge, p. p. m.	O_2 required (p. p. m.) for complete oxidation of glucose removed	Percentage oxidation of glucose removed	Maximum possible percentage oxidation of glucose by all O_2 used in fed sludge
	Sludge plus glucose	Sludge control	As a result of glucose added				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1½	107.0	26.6	80.4	1,072.0	1,149.0	7.0	9.3
3	146.4	43.1	103.3	1,099.0	1,172.0	8.8	12.5
4½	168.6	58.0	110.6	1,100.0	1,174.0	9.4	14.4
6	187.0	76.6	110.4	1,100.0	1,174.0	9.4	15.9
24	322.7	125.6	197.1	1,100.0	1,174.0	16.8	27.5
40	344.1	146.0	198.1	1,100.0	1,174.0	16.9	29.3

Derivation of data:
(3)=(1)−(2).
(5)=(4)×1.067.
(6)=(3)×100÷(5).
(7)=(1)×100÷(5).

oxidized. Additional experiments were run with and without supplemental nitrogen from which it is concluded that the addition of organic nitrogen with a single dose of 1,000 p. p. m. of glucose to our activated sludge had little if any effect upon the percentage of glucose oxidized.

TABLE 3.—*Summary of results of percentage oxidation of glucose removed from solution by activated sludge*

[All experiments conducted at 20° C.]

Classification of sludge on basis of its glucose removal ability	Experiment No.	Initial pH of fed sludge	Quantity of suspended sludge solids start at p.p.m.	Feed added: Glucose, p.p.m.	Feed added: Supplemental nitrogen	Percentage of glucose dose removed during first 1½ hours of aeration	Percentage oxidation of glucose removed in indicated time in hours: 1½	3	4½	23 or 24
Poor	70	7.0	3,422	405	None	10.3	75.6	23.9	31.9	------
Do	74	6.7	1,991	503	do	9.4	49.8	16.8	13.7	20.0
Normal	10	------	1,940	1,000	None	40.6	8.6	8.6	[1] 7.9	11.3
Do	55	6.6	2,856	1,025	do	10.0	4.5	12.4	9.6	21.2
Do	56	6.3	1,640	997	do	22.7	8.9	9.7	8.8	13.5
Do	58	7.3	3,104	957	do	14.8	------	5.9	4.8	14.8
Do	59	6.9	4,448	1,090	Glycine, 100 p.p.m.	34.8	8.2	11.4	15.8	------
Do	72	6.4	3,128	1,039	None	27.7	12.0	12.1	9.8	12.5
Do	64	------	2,720	470	do	26.6	11.5	10.2	14.8	21.1
Do	75	7.2	2,522	395	do	59.6	10.3	8.6	13.3	17.3
Do	79	7.4	3,150	935	do	15.4	24.0	24.6	25.9	31.8
Glucose acclimated	62	7.0	2,056	1,108	Glycine, 100 p.p.m.	97.0	7.0	8.8	9.4	16.8
Do	65	7.5	2,334	1,127	do	96.8	5.2	7.9	10.2	18.3
Do	69	7.2	2,131	5,155	1,000 p.p.m. urea.	14.0	11.5	11.3	11.6	------
Do	76	7.3	2,286	402	None	99.7	13.0	14.4	14.7	16.8
Combined average for normal and glucose acclimated sludges							10.4	11.2	12.0	17.8

[1] 5 hours.

Glucose oxidation experiments were also carried out on various activated sludge samples using doses of 400 to 5,155 p. p. m. of glucose. The percentage oxidation of glucose obtained after various aeration periods in each of 15 experiments of this kind is given in table 3. These data indicate that the quality of the sludge used and the quantity of glucose added affect the oxidation percentage of glucose removed from solution during the first few hours of the aeration period. If a dose of glucose up to 500 p. p. m. is added to a sludge which removes glucose at a very low rate, as illustrated in experiments 70 and 74, the indications are that a high percentage of the glucose removed may be oxidized in the first 1½-hour period. Thereafter the percentage oxidized falls for several hours and, after the glucose has all been removed from solution, slowly rises again. The sludge in experiment 70 removed glucose very poorly during the first 1½-hour aeration period, but in other respects this sludge appeared normal. The sludge in experiment 74 was the only bulking sludge used in these experiments. This sludge contained large quantities of *Sphaerotilus*

natans and the sludge index (volume in ml. containing 1 gram of sludge after 30-minute settlement) was 182. The glucose removal and oxidation characteristics of pure cultures of *Sphaerotilus natans* will be discussed in a later paper.

Data obtained in 9 experiments with normal sludge are given in the middle section of table 3. These experiments indicate the tendency of the percentage of glucose removed that is oxidized to increase slowly during the aeration period. The mean percentages of glucose oxidized for these experiments are 11.0, 11.5, 12.3, and 17.9 for the 1½-, 3-, 4½-, and 23-hour aeration periods, respectively. The data obtained with glucose acclimated sludge in experiments 62, 65, 69, and 76 are given in the lower section of this table. The column of this table giving the percentage of glucose removed from solution shows over 95 percent glucose removal in three of these experiments in the first hour and a half. In experiment 69, 5,155 p. p. m. of glucose were fed to a sludge containing 2,131 p. p. m. of suspended solids and even with this extremely high dose 14 percent, or 722 p. p. m., were removed from solution in an hour and a half. The percentages of glucose oxidized with the glucose acclimated activated sludge were very similar to the values for normal sludge.

These values for percentage oxidation of the glucose removed are surprisingly low in view of the velocity of the removal reaction and the belief expressed by Eldridge and Robinson (*6*) that carbohydrates are completely oxidized to CO_2 and H_2O by biochemical oxidation in the activated sludge process. Consequently, experiments similar to the above were carried out with several other bacterial agents capable of attacking glucose. The results obtained are summarized in table 4 and indicate that plant activated sludge oxidized a smaller percentage of the removed glucose than did the other agents used.

TABLE 4.—*Comparison of percentage oxidation of glucose by several bacterial agents after various periods of aeration*

Bacterial agent	Percentage oxidation of glucose removed in indicated time in hours				
	1½	3	4½	10	24
Normal activated sludge	11 0	11 5	12 3	--------	17 9
Pure culture zoogleal sludge [1]	31 0	33 1	33 5	--------	45 1
Bact coli culture	--------	21 6	--------	28 1	30 6
Bact aerogenes culture	--------	13 1	--------	31 7	44 6

[1] Mean of seven experiments employing two zoogleal strains.

The percentage oxidation of glucose removed by activated sludge is equivalent to the percentage of the total carbonaceous oxygen demand reduction of a sewage substrate that is actually oxidized under aeration with a nonnitrifying activated sludge as given in an

earlier paper (7). Consequently, a comparison of these values is made below:

Substrate	Percentage of L value reduction that is actually oxidized in indicated time in hours—				
	1½	3	4½ or 5	10	24
Domestic sewage	21 9	31 6	37 9	48 4	57 6
Glucose	11 0	11 5	12 3	----------	17 9

These data indicate a very decided difference in the metabolism of glucose and of sewage by activated sludge. The percentage of the substrate oxidized is much lower for this easily attacked carbohydrate than for sewage. Consequently, a much higher percentage of the glucose removed must be credited to adsorption and assimilation or synthesis.

An experiment which illustrates the difference in the disposal mechanism of glucose and peptone was carried out. In this experiment an 8 liter sample of plant sludge, upon its removal from the plant, was dosed with 500 p. p. m. of peptone, and the oxidation as a result of this feed was determined on portions of this sludge. On the second day 1,039 p. p. m. of glucose were added to the sludge remaining after 1 liter was taken for a control and the oxidation resulting from the glucose dose was determined. On the third day 500 p. p. m. of peptone were again fed and the oxygen utilization of the control and fed portions was again determined. The results are given in table 5. It is noticeable that the oxygen utilization of the control sludge was very similar during the three successive tests. While the oxygen utilization results of the sludge fed with 500 p. p. m. of peptone on the first and third day were very similar, these results were much greater than the quantities of oxygen utilized by the sludge fed with 1,039 p. p. m. of glucose on the intervening day. It is strikingly shown that while larger quantities of glucose than peptone were removed from solution by activated sludge in this experiment, much less oxygen was used during the glucose removal than during peptone removal. Thus while only about 12 percent of the glucose removed from solution was oxidized in 22 hours by activated sludge, over 50 percent of the peptone removed was oxidized during the same aeration time. The experiment also showed no detriment to the peptone oxidizing ability of the sludge by the intervening treatment with 1,000 p. p. m. of glucose. These data again illustrate the difference in the glucose metabolism over that of peptone and sewage.

TABLE 5.—*Comparison of the oxidation of peptone and glucose by activated sludge upon successive days*

Aeration time, hours	Oxygen utilized, p. p. m			Total B. O. D. of substrate feed removed	Percentage oxidation of substrate removed
	Sludge plus feed	Sludge control	As a result of feed		
FIRST DAY FEED 500 P. P. M. PEPTONE					
1½	72.7	21.1	51.6	207.0	24.9
3	116.4	37.6	78.8	255.0	30.9
4½	153.2	47.7	105.5	289.0	36.5
22	402.7	126.8	275.9	537.0	51.4
SECOND DAY FEED 1039 P. P. M. GLUCOSE					
1½	47.1	10.3	36.8	307.0	12.0
3	86.3	18.8	67.5	557.0	12.1
4½	112.0	34.3	77.7	790.0	9.8
5½	134.0	46.8	87.2	955.0	9.1
22	271.9	134.4	137.5	1,096.0	12.5
THIRD DAY FEED 500 P. P. M. PEPTONE					
1½	81.6	19.2	62.4	207.0	30.1
3	115.9	31.0	84.9	255.0	33.3
4½	158.6	34.5	124.1	289.0	42.9
5½	185.7	39.7	146.0	312.0	46.7
22	414.7	128.3	286.8	537.0	53.4

Another experiment was performed which showed that when activated sludge was dosed with sewage plus glucose very little more oxygen was utilized than when sewage was added alone. Table 6 is self-explanatory and presents the data obtained. In each case the quantities of oxygen utilized as a result of the addition of the feed were obtained by subtracting the quantities of oxygen used by the control sludge portions from the quantities used by the portions fed with sewage and with sewage plus 500 p. p. m. of glucose. It will be noted that 500 p. p. m. of glucose has an oxygen demand L value of 534 p. p. m. and consequently practically doubles the total carbonaceous oxygen demand of the substrate feed when it is added to domestic sewage. Nevertheless, the addition of this carbohydrate load to the sewage did not increase the oxygen utilization appreciably. In fact, the corresponding oxygen utilization figures for the sewage and sewage plus glucose substrates are all within the limits of error of the determinations with the exception of the 3- and 5-hour observation results upon the B portions. Very little more oxygen is needed when 500 p. p. m. of glucose are added to sewage even though all of the glucose is removed during the aeration period.

TABLE 6.—*Quantities of oxygen utilized to oxidize substrate by activated sludge under aeration*

Description of treatment of sludge.	Initial normal sludge taken from plant.		Portion A after dosing daily with sewage for 9 days.		Portion A after dosing daily with same sewage fortified with 500 p. p. m. of glucose for 7 days.	
Oxidation tests upon portions treated as above.	A		B		C	
	Oxygen utilized as a result of the addition of the feed, p. p. m.					
Feed added	Sewage	Sewage plus glucose	Sewage	Sewage plus glucose	Sewage	Sewage plus glucose
Aeration time, hours:						
½	21.6	19.0	9.8	14.3	40.1	32.4
1	30.3	26.8	25.9	28.3	42.7	40.2
3	65.0	64.5	81.6	109.9	65.6	59.0
5	90.2	96.9	123.4	154.5	79.1	79.8
23	----------	----------	324.2	325.3	116.6	117.9

It might be assumed that, because little additional oxygen is used when glucose is added with sewage to activated sludge, the short time oxygen requirement of the sludge would increase rapidly. The quantities of oxygen in mg. used per gram of dry sludge in the control portions of A, B, and C of the above experiment are as follows for the indicated aeration times:

Aeration time (hours)	Mg. O_2 used per gram of sludge		
	A	B	C
½	1.13	2.88	3.42
1	3.03	6.25	9.43
3	9.47	10.28	11.75
5	10.76	10.48	14.80

These results show that the 7 repeated treatments with sewage containing 500 p. p. m. of glucose which sludge portion C received did increase its short-time oxygen demand somewhat over the initial sludge and over the sewage-dosed portion B. However, in a sludge-overloading experiment previously described (*8*), it was indicated that 5-hour sludge demands of 20 mg. of oxygen per gram were perfectly satisfactory. In the above case 5-hour sludge demands of 62.8 mg. of oxygen per gram were obtained when the sludge was badly overloaded. From this it is concluded that dosing sewage containing 500 p. p. m. of glucose daily to activated sludge for 7 days did not produce an overloaded or inferior sludge upon the basis of short-time oxygen demand.

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In several experiments the carbon dioxide produced was determined simultaneously with the oxygen used in both control and glucose-fed sludge mixtures. These experiments gave respiratory quotients of 0.89 to 1.15 for glucose acclimated activated sludge alone and 1.08 to 1.17 for activated sludge-glucose mixtures. These values are in conformity with the respiratory quotient data of Sawyer and Nichols (*9*) upon activated sludge and activated sludge-sewage mixtures. When the carbon dioxide produced as a result of the glucose feed was estimated by the difference method, which has been used for determining the oxygen used to oxidize glucose, the respiratory quotient obtained for the glucose metabolized during a 4½-hour aeration period was 1.04. This is within the experimental error that might be expected of the theoretical respiratory quotient of 1.0 for carbohydrate metabolism. The dissimilation product, carbon dioxide, obtained in these experiments checks the oxidation data and on the average accounts for only about 17 percent of the glucose removed in a 24-hour aeration period. This immediately raises the question of the exact disposition of the large portion of glucose that has been removed from solution but is not accounted for by complete oxidation. The final experiment in the previous section indicated indirectly that little if any of the balance of the glucose remains adsorbed upon the surfaces of the sludge floc. For if much glucose remained in this way the short-time sludge demand would certainly increase rapidly with repeated dosing.

A direct experiment to determine whether glucose remains adsorbed upon the surfaces of the floc was also performed by attempting to recover glucose from sludge in which glucose removal from solution had just been completed. Such a sludge was separated from the supernatant liquor, which contained only 6.0 p. p. m. of glucose, by centrifuging. The separated solids were resuspended in a quantity of distilled water of the same volume as the supernatant removed. The resuspended sludge was boiled for 30 minutes under a reflux condenser and the reducing extracts were determined and calculated in terms of glucose. The results in p. p. m. of glucose obtained are as follows:

Glucose acclimated sludge 3 hours after receiving 1,100 p. p. m. of glucose	Glucose acclimated sludge 4½ hours after receiving 1,100 p. p. m. of glucose	Plant sludge which never had been dosed with glucose
43.3	45.2	58.0

This experiment shows conclusively that the glucose removed from solution is not simply adsorbed upon the surfaces of the sludge floc. At the 3-hour point in this experiment the sludge had just completed

the removal of 1,100 p. p. m. of glucose from the supernatant. The oxygen utilization results have indicated that only about 10 percent of this glucose was oxidized and yet less than 5 percent of the original dose was recovered by extraction with boiling distilled water. The experiment also showed that it was possible to extract as much reducing organic matter from the plant activated sludge as from this glucose-fed activated sludge immediately after the completion of the glucose removal reaction. When the sludges in the above experiment were extracted with boiling hydrochloric acid solution, more reducing material was recovered from the glucose-fed sludge than from the plant sludge. This seems to indicate that the sludge which had removed the glucose contained a larger quantity of a higher nonreducing carbohydrate which was hydrolysed by the boiling acid solution. Even after 30-minute treatment with boiling hydrochloric acid solution, however, less than 20 percent of the glucose equivalent of the original dose could be recovered 3 hours after the glucose was fed. This indicates that a large proportion of the glucose removed from solution is quickly transformed in the bacterial cell to other materials, possibly higher carbohydrates or fats.

It might be assumed that glucose dissimilation of one of the types described by Thaysen and Galloway (*10*) was produced by activated sludge in which soluble, volatile organic acids are end products. Smit (*11*) states that such products could not be found and our efforts to recover volatile organic acids from glucose-fed sludge were also unsuccessful.

Experiments in which glucose removal and total B. O. D. removal were followed simultaneously gave interesting results. In these experiments the 3-, 5-, and 7-day B. O. D. of the supernatant of the sludge was determined initially and 1½, 3, 4½, and 23 hours after glucose feeding. A mean L value or total carbonaceous oxygen demand was calculated from the 3-, 5-, and 7-day B. O. D. results at each observation time and from these data the percentage of the L value removed at each time was calculated. Below, these percentages of the L value removed are compared to the percentages of glucose removal obtained from glucose determinations:

Aeration time (hours)	1½	3	4½	23
Percentage of L value removed	66.6	96.4	97.5	98.8
Percentage of glucose removed	68.7	98.9	98.9	98.9

It will be noted that the greatest difference between the percentage of glucose and of total B. O. D. removed was 2.5 at 3 hours. As about 1,000 p. p. m. of glucose were fed, the maximum quantity of soluble organic products that might have been formed in this experiment would be equivalent to 25 p. p. m. of glucose. This indicates that if

such products are formed they are formed in only extremely minute quantities compared to the quantities of these products formed by the common fermentation processes. For practical purposes it may be considered that the B. O. D. removal of glucose parallels and is equivalent to the glucose removal by activated sludge under aeration. This means that in this process any volatile soluble organic products formed from glucose are either retained by the sludge and are not discharged into the supernatant or that no such products are formed. If volatile organic acids were formed in any quantity and retained by the sludge they would be indicated by a drop in pH and they could be recovered from the sludge by steam distillation. As significant pH drops are not obtained after glucose feeding and volatile acids cannot be recovered by steam distillation, it must be concluded that such products are not formed to any significant extent during the removal and metabolism of glucose by activated sludge.

INCREASE IN ACTIVATED SLUDGE SOLIDS AS A MEASURE OF GLUCOSE ASSIMILATION

As only a small portion of the glucose is oxidized and practically no soluble organic compounds are produced during glucose removal by activated sludge, a very significant increase in sludge solids would be expected. Mention was made in the preceding paper (*1*) of significant increases in sludge solids during glucose feeding. Because of sampling difficulties and errors, special care must be exerted in studying sludge production during glucose feeding. Activated sludge is a biological material in which the basal metabolism continues and the weight of sludge decreases under aeration when it is not fed. Consequently, it is necessary to follow the weight changes in a control sludge and a glucose-fed sludge in studying sludge production during the glucose removal reaction. In our experiments to determine sludge production, 3 or 4 replicate 25-ml. portions of the control and fed sludge liquors were removed and filtered through prepared Gooch crucibles at each observation time. By this means fairly accurate data upon the changes in sludge solids were obtained. In order to reduce the number of samples that needed to be filtered and weighed during a test, factors for converting the oxygen used by the control sludge to solids lost by oxidation were determined. These factors were obtained by observing the oxygen utilized and the suspended sludge solids remaining simultaneously at intervals during aeration of a number of samples of control activated sludge. The mean ratio of sludge solids lost in milligrams per milligram of oxygen used was 1.12. In estimating the activated sludge solids remaining at any time in the control bottles, the quantity of oxygen used to that time was multiplied by the above factor and the result was subtracted

from the initial value for suspended solids. Because of the small loss of solids during short aeration periods in control sludge and the fact that the oxygen utilized data must be obtained in any case, it was preferable to calculate the solids burned in this way rather than to make additional numbers of suspended solids determinations upon the control sludge for each experiment.

TABLE 7.—*Sludge production during glucose metabolism by activated sludge*

[Experiment G-79. Initial suspended solids 3,150 p. p. m. Glucose dose 935 p. p. m.]

Aeration time, hours	Glucose removed from solution, p. p. m.	Oxygen utilized by, p. p. m.		Sludge found in sludge-glucose mixture, p. p. m.	Sludge remaining in control mixture, p. p. m.	Glucose accounted for by increase in sludge solids, p. p. m.	Percentage of glucose removed that is accounted for by—		
		Sludge-glucose mixture	Sludge control mixture				Increase in sludge solids	Oxidation	Increase in solids and oxidation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1½	144	61.9	22.3	3,241	3,125	116	80.6	24.0	104.6
3	280	107.4	83.9	3,320	3,112	208	74.3	24.6	98.9
4½	395	166.8	57.5	3,384	3,086	298	75.4	25.9	101.3
6	508	213.9	67.0	3,446	3,075	371	73.0	27.1	100.1
10	756	325.3	115.4	3,569	3,021	548	72.5	26.0	98.5
24	885	525.2	230.8	3,452	2,891	561	63.4	31.8	94.6

(5) These values are obtained by subtracting the products of the factor 1.12 and column 3 from the initial suspended solids.
(6) = (4) − (5).
(7) = (6) × 100 ÷ (1).
(8) Calculated as shown in column 6 of table 1.

The data obtained in a study of the production of sludge from glucose by aeration with normal activated sludge have been tabulated in table 7. A glucose dose of 935 p. p. m. was given to 3,150 p. p. m. of sludge in this test and column 1 in the table shows that the glucose was removed steadily, the removals obtained ranging from 144 p. p. m. in 1½ hours to 885 p. p. m. in 24 hours. The quantities of oxygen utilized by the sludge-glucose mixture and the control mixture are given in columns 2 and 3. The quantity of sludge found in the sludge-glucose mixture increased regularly during the first 10 hours and decreased somewhat thereafter, as shown in column 4. The rate at which the sludge solids increased and decreased again varies in different experiments and depends upon the rate of glucose metabolism. The quantity of sludge remaining in the control was calculated from the oxygen used in the control as previously described. The quantities of glucose that may be accounted for by an increase in sludge solids as a result of the glucose metabolism increased from 116 p. p. m. after 1½ hours to 561 p. p. m. after 24 hours. The percentages of glucose removed that can be accounted for by the increase in sludge solids and by oxidation are given in columns 7 and 8, respectively. It will be noted that 80.6 percent of the glucose removed is accounted for as an increase in sludge solids after 1½ hours

of aeration and that this percentage falls to 63.4 percent after 24 hours. When the percentage glucose removal accounted for as an increase in sludge solids is added to the percentage accounted for by oxidation, it will be noted (column 9) that practically all of the glucose removed has been accounted for at each observation interval. In fact, the values obtained in this experiment all seem to be within the experimental limits of error. This is not always the case, for in some experiments only 70 to 90 percent of the glucose removed has been accounted for by the data obtained and treated in this manner. However, the percentages of glucose removed that are accounted for by an increase in solids remained very similar to the values given in table 7. The percentages accounted for by oxidation vary considerably as already shown in table 3.

Similar experiments upon the production of sludge during glucose feeding were performed with pure culture sludges formed by single strains of zoogleal bacteria, developed upon synthetic sewage (*4*) which contained no glucose. The data for a typical experiment with such sludge are given in table 8. These data were obtained and treated in the same manner as the data for normal sludge as given in table 7. It will be noted that the percentages of glucose removed, that may be accounted for by solids formation by pure zoogleal cultures, are decidedly lower than for normal activated sludge. On the other hand, the percentage of the glucose removed that is completely oxidized is higher for the pure zoogleal culture than for normal activated sludge. These results warrant the conclusion that there is a definite difference between the aerobic metabolism of glucose by pure zoogleal cultures and that by normal activated sludge. The normal sludge in every case seems to assimilate and synthesize a greater portion of the glu-

TABLE 8.—*Sludge production during glucose metabolism by pure culture zoogleal sludge*

[Strain No. 86. Initial culture solids 686 p. p. m. Glucose dose 505 p. p. m.]

Aeration time, hours	Glucose removed from solution, p. p. m.	Oxygen utilized by, p. p. m.		Sludge found in sludge-glucose mixture, p. p. m.	Sludge remaining in control mixture, p. p. m.	Glucose accounted for by increase in sludge solids, p. p. m.	Percentage of glucose removed that is accounted for by—		
		Sludge glucose mixture	Sludge control mixture				Increase in sludge solids	Oxidation	Increase in solids and oxidation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1½	71.2	35.6	6.8	702	678	24	33.9	37.9	71.8
3	153.0	63.9	15.4	734	669	65	42.5	29.7	72.2
4½	217.0	89.5	27.0	752	656	96	44.2	27.0	71.2
6	293.0	113.9	27.8	772	655	117	39.9	27.4	67.3
24	438.0	259.6	76.6	800	600	200	45.7	39.0	84.7

(5) These values are obtained by subtracting the product of the factor 1.12 and column 3 from the initial suspended solids.
(6)=(4)−(5).
(7)=(6)×100÷(1).
(8) Calculated as shown in column 6 in table 1.

cose removed from solution. The quantity of dissimilation products other than CO_2 obtained with both normal activated and pure culture sludge seems to be but a small fraction of the glucose removed.

METABOLISM OF GLUCOSE IN GLUCOSE ACCLIMATED SLUDGE

The acceleration of the glucose removal rate by activated sludge with repeated glucose feeding was first noted by Smit (*11*) and was clearly demonstrated in the previous paper (*1*). It has been suggested (*1*) that one of the reasons for this acclimatization phenomenon was the development of adaptive glucose enzymes by the predominant bacteria of the sludge. To determine whether this might be the case, and whether the glucose metabolism was influenced by such possible acclimatizations, a number of experiments were carried out with pure culture zoogleal sludges. These sludges were developed on synthetic sewage in the bacteriological laboratory. When the cultures contained about 800 p. p. m. of bacterial suspension they were divided into two portions. The feeding of synthetic sewage (containing no glucose) was continued on one portion while the second portion was fed with synthetic sewage fortified with 500 p. p. m. of glucose for 4 or 5 days. The glucose metabolism tests were then made upon these two portions. The glucose removal results obtained in these experiments have been summarized in table 9. These data show that treatment of these cultures for a few days with glucose accelerated very decidedly the rate of glucose removal. These experiments indicate that the mechanism of glucose removal is adaptive for these strains of bacteria and can be accelerated by proper feeding procedures.

TABLE 9.—*The influence of previous glucose feeding upon the removal of glucose from solution by pure culture zoogleal sludge (mean for 3 pairs of experiments)*

[Mean glucose dose, nonacclimated cultures, 493 mg. per liter. Mean glucose dose, acclimated cultures, 485 mg. per liter]

Aeration time, hours	Mg. of glucose removed from substrate per gram of sludge per liter in indicated time		Percentage of the glucose removed from substrate by one gram of sludge per liter in indicated time	
	Nonacclimated	Acclimated	Nonacclimated	Acclimated
1½	158	252	32 0	52.0
3	228	328	46.2	67 6
4½	277	317	56.2	73.6
24	483	439	98.0	90.5

Careful study of data obtained in all glucose metabolism experiments failed to show any difference in this metabolism before and after glucose acclimatization with either normal activated sludge or pure culture zoogleal sludge. The results of all experiments on metabolism with pure culture and normal activated sludge have,

therefore, been summarized in table 10. This table indicates the difference in the mean metabolism of glucose by the two kinds of sludges. It shows that the percentage of oxidation is higher and that the percentage of glucose synthesized is considerably lower for these zoogleal cultures than for normal activated sludge.

TABLE 10.—*Mean percentage metabolism of glucose removed from solution by normal activated sludge and pure culture zoogleal sludge*

Aeration time, hours	Normal activated sludge			Pure culture zoogleal sludge		
	Synthesized to sludge	Oxidized to CO_2	Total accounted for	Synthesized to sludge	Oxidized to CO_2	Total accounted for
1½	77 3	13 6	90 9	39 0	31 0	70 0
3	70 5	14 6	85 1	49 4	33 1	82 5
4½	71 2	15 0	86 2	58 1	33 5	91 6
6	71 2	16 7	87 9	50 7	32 0	82 7
24	73 3	17 8	91 1	48 4	45 1	93 5

POSSIBLE ASSIMILATION PRODUCTS OF GLUCOSE METABOLISM

An attempt was made to determine whether the fat, fatty acids, and hydrogel contents of activated sludge were changed by the prolonged assimilation of glucose. An analysis of activated sludge before and after 60 doses of sewage containing 500 p. p. m. of glucose over a 30-day period was made. All of the glucose fed in this period was metabolized by the sludge. The methods of analysis used by Knechtges, Peterson, and Strong (*12*) for fats and free fatty acids in sludge were employed. The results indicated no appreciable change in either of the above constituents. However, the question of variation or change in the hydrogel content of the sludge has not yet been definitely answered.

DISCUSSION

All of these data indicate that glucose was removed biologically from solution at a much higher rate than oxidation of glucose occurred. With normal activated sludge the glucose was removed from 5 to 7 times as fast as the rate of its decomposition as measured by oxygen consumption and CO_2 production. Zoogleal sludge removed glucose at about three times the rate at which it was oxidized to CO_2. This fact has not been pointed out for activated sludge or zoogleal sludges before. Hawkins and Van Slyke (*13*), however, found that the rate of glucose removal took place more than twice as fast as the rate of decomposition measured by CO_2 production during the initial stages of fermentation by yeasts. Wilson and McLachlan (*14*), in studying the carbon dioxide production in the activated sludge process, express the view that carbon dioxide is not the only product of aerobic oxidation. Following a study of the carbon balance in the process upon a

laboratory scale they conclude that only about 10 percent of the transformation products of carbon appear as CO_2. They suggested the possibility of dehydrogenation in the process but did not demonstrate any dissimilation product other than CO_2. Our data on CO_2 production, while somewhat higher, roughly confirm their findings. Dehydrogenation products of dissimilation, however, could not be found and in this respect our findings confirm those of Smit (*11*). Watkins (*15*) isolated a number of strains of bacteria from activated sludge and sprinkling filter slime which attacked glucose without acid formation as a dissimilation product and it seems probable that these organisms metabolized glucose in a way similar to activated sludge and the pure culture zoogleal sludge.

In a study of the synthesis of cell substance by yeast under vigorous aerobic conditions, Fink and Krebs (*16*) reported a yield of 52 percent of dry substance from 1 percent sugar solutions. Their results indicated that an increase in the percentage of cell substance was obtained as the percentage of sugar was decreased. Winzler and Baumberger (*17*) reached the conclusion that, in the presence of oxygen, yeasts burned 26.5 percent of the glucose which disappeared from the medium and stored 73.5 percent of it as intracellular carbohydrate. This synthesis was demonstrated by the results obtained from the heats of formation and the heat production measured during exogenous respiration. The results of the above investigators upon yeasts with entirely different methods are remarkably similar to the percentages of oxidation and synthesis of glucose obtained on these studies with activated sludge. It is not intended to imply that yeasts are involved in the activated sludge process. While yeasts may be present in the sludge, they are certainly not the predominant organisms. Our data support the work of Winzler and Baumberger in regard to the percentage of glucose that may be assimilated as intracellular carbohydrate in respiring bacterial processes. Werkman (*18*) defines bacterial respiration (aerobic dissimilation) as a process utilizing molecular oxygen as a hydrogen acceptor. The activated sludge metabolism of glucose conforms to this definition. However, in the metabolism of glucose by activated sludge only a small portion of the glucose that disappears is consumed in the respiratory process and a large portion of the glucose is stored. Consequently aerobic dissimilation is descriptive of only the minor portion of this process. As most of the glucose is stored in the process, assimilation and not dissimilation should be emphasized. It would seem therefore that this metabolism can best be described in the terminology of Clifton and Logan (*19*) as an oxidative assimilation. In the words of these authors, the results "suggest that respiration and assimilation are closely connected

processes and the respiration of heterotropic bacteria may well be expressed by the general equation:

$$\text{Foodstuff}+O_2 \xrightarrow{\text{oxidative assimilation}} \text{Assimilated material}+CO_2+H_2O;$$

much as $CO_2+H_2O+\text{light} \longrightarrow (CH_2O)+O_2$ represents the assimilatory process in the green plant."

With glucose the activated sludge process by this oxidative assimilation mechanism transforms over 60 percent of the foodstuff to assimilated material.

It has been shown that glucose was metabolized in a different way than peptone or sewage by activated sludge and that a much greater assimilation and synthesis occurred with glucose than with peptone or sewage. When glucose alone in doses up to 1,000 p. p. m. is fed to normal activated sludge, rapid assimilation occurs and it is inferred that the sludge already contains sufficient nitrogen and mineral constituents to metabolize the glucose. When domestic sewage containing large quantities of glucose (500 to 1,000 p. p. m.) is fed repeatedly to activated sludge, the sewage apparently furnished sufficient nitrogen and mineral constituents for metabolic purposes for the glucose is rapidly assimilated as shown. It is this fundamental difference that explains the much greater production of solids obtained by feeding glucose to activated sludge or pure cultures of zoogleal bacteria. Glucose is not only removed from solution at a somewhat higher rate than peptone but a considerably greater proportion of it is assimilated to appear as protoplasm in either of these biological systems.

Applying the above facts to practical plant operation, the production of larger volumes of sludge would be expected with sewage containing glucose wastes, even in the absence of sludge bulking. The larger the glucose content of the sewage the greater the volume of sludge that is to be expected at the plant for any practical period of aeration. For this reason it is apparent that a ratio of capacities of plant aeration to settling that is satisfactory for domestic sewage might be unsatisfactory for sewage containing carbohydrate wastes. As more sludge is being synthesized from such sewage, greater settling tank capacity would have to be provided, a smaller portion of the sludge produced would be needed for sludge return, and a larger portion would have to be disposed of.

SUMMARY AND CONCLUSIONS

The oxygen relationships of the glucose removal reaction by activated sludge and pure culture zoogleal sludge were studied. It was shown that the percentages of glucose removed that were oxidized varied from 4.0 to 24.0 percent after 1¼ hours and from 11.3 to 31.8 percent after 24 hours of aeration with activated sludge. Pure culture zoogleal sludges oxidized on the average 31.0 percent in 1¼

hours and 45.1 percent in 24 hours of the glucose that they removed. It was shown that 1,000 p. p. m. of glucose with an L value (total carbonaceous biochemical oxygen demand) of 1,067 p. p. m. when added to a normal activated sludge did not increase the short-time oxygen requirement of the sludge-feed mixture to as great an extent as 500 p. p. m. of peptone with a much lower L value. This is true even when ammonia nitrogen is not being oxidized. This may be explained by differences in the metabolism of these two materials by activated sludge. Repeated feeding of sewage containing 500 p. p. m. of glucose did not increase the short-time oxygen demand per gram of sludge sufficiently to be detrimental to the substrate oxidation ability of the sludge.

A search for dissimilation products of glucose metabolism was made. It was found that once the glucose was removed from solution, it could not be recovered by simple extraction processes. The glucose removal reaction was, therefore, considered to be the result of biological metabolism following adsorption and not simple adsorption upon the surfaces of the floc. The respiratory quotient of glucose metabolism by activated sludge was 1.0. Other dissimilation products besides CO_2 could not be demonstrated by drops in pH during the reaction nor could such products be recovered by steam distillation of the sludge. It was observed that glucose removal and total carbonaceous biochemical oxygen demand removal of glucose were practically equivalent. From this it was concluded that other soluble dissimilation products were either not formed at all or not formed to a sufficient extent to be discharged into the substrate liquor.

The increase in sludge solids was studied as a measure of glucose metabolism and assimilation. Because of the biological character of the reaction, suspended solids were followed in both an activated sludge-glucose mixture and in an unfed sludge mixture as a control. The differences in solids following short periods of aeration represent the glucose assimilation. Such observations indicated that almost 80 percent of the glucose removed is assimilated and appears as protoplasm within 1½ hours of aeration. This percentage of assimilation slowly falls as the aeration is continued, but even after 24 hours over 70 percent of the glucose removed can still be accounted for by the increase in sludge solids. A similar but somewhat lower assimilation and synthesis was demonstrated for pure culture zoogleal bacteria. It was shown that the mechanism of glucose removal by pure zoogleal cultures was adaptive and could be accelerated by repeated doses of a balanced feed containing glucose. An increase in fats or fatty acids could not be demonstrated in sludge which had assimilated glucose for a 30-day period. From 80 to 100 percent of the glucose removed can be accounted for as the sum of the glucose oxidized and that assimilated to protoplasm. On the basis of these experiments,

it must be concluded that the removal of glucose from solution by normal activated sludge and pure cultures of zoogleal bacteria is largely an oxidative assimilation reaction. In this reaction the greater part of the glucose is assimiliated and appears as protoplasm within the sludge in a few hours after the glucose is fed. Dissimilation products other than carbon dioxide cannot be demonstrated during this metabolism and, upon the basis of these data, can in any case represent only a relatively small fraction of the glucose metabolized.

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INFECTIOUS EQUINE ENCEPHALOMYELITIS IN THE UNITED STATES IN 1939

Although equine encephalomyelitis may have existed in the United States for a great many years,[1] attention was recently focused on the disease by the outbreak in Massachusetts in 1938, in which human cases of encephalitis also occurred. Of 38 suspected human cases investigated, 8 were proved, 5 of which, occurring within 15 miles of each other, were concentrated in the area in which the equine disease was prevalent. There was no indication of human contact infection in these cases.[2] Mosquitoes were reported to have been unusually prevalent at the time of the outbreak.

In 1939, Dr. McAdams and Dr. Porter, of Fall River, Mass., reported a case of encephalitis in an adult in which the etiological agent was isolated and proved to be identical with that of the virus of the eastern type of equine encephalomyelitis.[3] They believed this to be the first reported case in a human adult proved in this manner.

In view of the probable relationship between infectious equine encephalomyelitis and encephalitis in human beings, and the epidemiological factors involved, information regarding the incidence, mortality, and distribution of the equine disease in the United States is of especial interest to public health officials and research workers. In a recent report,[4] Dr. J. R. Mohler presents some interesting data for 1939, compiled from responses to questionnaires sent to the various State livestock sanitary officials and Bureau of Animal Industry inspectors.

In 1939, only 8,008 cases of equine encephalomyelitis were reported in the United States, or only about 4 percent of the number of cases (184,662) reported in 1938. There were 2,471 deaths from the disease. These figures give a case rate of 1.1 per 1,000 animals (horses and mules) in the affected counties, and a case fatality of 30 percent.[5]

[1] Transmission of encephalomyelitis in the horse and possible vectors in the human being. By James Stevens Simmons. New Eng. J. Med., 22: 956–958 (Jan. 8, 1939).

[2] Outbreak of encephalitis in man due to the eastern virus of equine encephalomyelitis. By R. F. Feemster. Am. J. Pub. Health, 28: 1403–1440 (December 1938).

[3] Encephalitis in man caused by the virus of equine encephalomyelitis. By James C. McAdams and Joseph E. Porter. New Eng. J. Med., 221: 163–166 (Aug. 3, 1939).

[4] Report on infectious equine encephalomyelitis in the United States in 1939. By J. R. Mohler, Bureau of Animal Industry, Department of Agriculture. Mimeographed statement, January 20, 1940.

[5] In these computations some States with incomplete mortality records are excluded.

The total numbers of animals in the affected counties were approximately the same for the 2 years (7,654,149 in 1938 and 7,159,491 in 1939). In 1939 every State west of the Mississippi River was involved, and approximately one-third of all counties or parishes in the entire country reported infected animals.

In general, the highest incidence rates were reported for counties in the far western and Pacific States, a northeast-southwest strip of Central States, and three Atlantic States, New Jersey, North Carolina, and Florida.

The case fatality rate for the eastern type of virus was apparently more than 3 times as high as that for the western type. In 24 States where only the western type has been proved or suspected, the case fatality was 26.7 percent, as compared with 89 percent in 9 States where only the eastern type has been proved or suspected. Limited, but apparently significant, figures show an average of 22.6 percent fatality in animals under 1 year as compared with 37.4 percent in those over 1 year of age.

As in previous years, over 90 percent of the cases were reported to have occurred during the summer or early fall. Of the cases reported during other months, only one (in Florida in January) was confirmed in the laboratory. This seasonal prevalence tends to support the prevailing conception regarding the principal natural means of transmission, by blood-sucking insects, especially mosquitoes.

The reported incidence of encephalomyelitis in vaccinated and unvaccinated horses and mules was 0.37 and 1.2, respectively, per 1,000 animals. It was estimated that no less than 3,000,000 horses and mules (about one-fifth of the total in the United States) received specific prophylactic treatments, some of which animals were undoubtedly in the incubation stage of the disease at the time of vaccination. Two 10-cc. doses of formolized chick-embryo tissue vaccine, given at intervals of 7 to 10 days, were commonly used.

In commenting on the possible factors influencing the reduction in the incidence of equine encephalomyelitis in 1939 as compared with 1938, Dr. Mohler considers vaccination one of the major factors, and suggests, in addition, the retarding of insect breeding as the result of low precipitation rates, and increased resistance among animals due to frank attacks in preceding epizootics.

INFANT DEATH RATES IN THE UNITED STATES, BY STATES, FOR 1938 AND PRIOR YEARS

According to figures recently issued by the Bureau of the Census the infant mortality rate for continental United States was 51.0 in 1938, the lowest rate since the birth registration area was established in 1915 and undoubtedly the lowest in the history of the country.

The report of the Bureau of the Census presents the numbers of infant deaths and the rate (per 1,000 live births) for each year from 1915 to 1938, but in the accompanying table the rates are given by 5-year periods from 1915 to 1935 and by year for 1935 to 1938. In 2 years, 1916 and 1918, the rate was above 100. Since 1918 it has been reduced almost 50 percent.

As is the case with the general mortality rate, the infant mortality rate for the country as a whole obscures unnecessarily high rates in

Infant death rates (number per 1,000 live births) by States, 1938 and comparison with prior years [1]

Area	1915	1920	1925	1930	1935	1936	1937	1938
Birth registration area [2]	99.9	85.8	71.7	64.6	55.7	57.1	54.4	51.0
Alabama	(3)	(3)	(3)	72.1	62.8	66.8	62.4	60.8
Arizona	(3)	(3)	(3)	116.6	111.7	119.6	120.7	98.8
Arkansas	(3)	(3)	(3)	51.5	47.1	50.9	54.5	51.4
California	(3)	74.4	68.7	58.7	49.6	53.1	53.8	43.7
Colorado	(3)	(3)	(3)	94.3	72.7	74.1	73.5	60.2
Connecticut	107.1	91.9	73.3	56.0	42.7	42.0	40.4	36.3
Delaware	(3)	(3)	90.5	78.5	66.4	64.5	63.8	52.8
District of Columbia	111.1	91.0	87.4	70.8	59.4	72.4	60.8	48.1
Florida	(3)	(3)	74.2	64.2	61.9	59.4	59.8	57.9
Georgia	(3)	(3)	(3)	77.4	68.3	70.0	61.7	67.7
Idaho	(3)	(3)	(3)	57.1	51.0	51.4	43.7	44.6
Illinois	(3)	(3)	72.5	55.8	45.9	46.8	43.1	40.9
Indiana	(3)	81.8	67.9	57.7	50.8	50.7	49.7	42.5
Iowa	(3)	(3)	56.0	53.9	47.1	48.2	44.2	40.5
Kansas	(3)	73.1	61.7	52.6	50.3	51.8	44.4	43.0
Kentucky	(3)	73.1	70.5	65.4	58.7	66.8	59.1	61.3
Louisiana	(3)	(3)	(3)	78.2	69.4	71.9	65.6	67.1
Maine	105.4	101.6	76.3	75.7	63.0	64.1	65.3	56.2
Maryland		104.1	90.0	75.3	62.0	69.1	61.5	55.7
Massachusetts	[illegible]	90.9	73.0	60.1	48.3	46.5	44.1	39.9
Michigan	86.0	91.7	75.3	62.7	47.7	50.7	47.9	44.6
Minnesota	70.2	66.4	60.3	52.5	44.7	44.4	40.8	38.8
Mississippi	(3)	(3)	68.5	67.7	53.9	58.2	58.9	56.7
Missouri	(3)	(3)	(3)	58.6	56.9	57.9	56.5	51.5
Montana	(3)	(3)	70.9	58.5	60.0	57.0	50.5	45.5
Nebraska	(3)	64.2	57.7	49.4	41.2	44.1	42.1	36.4
Nevada	(3)	(3)	(3)	68.3	71.0	69.8	40.2	47.7
New Hampshire	109.6	88.0	76.2	61.4	53.9	46.2	48.1	47.6
New Jersey	(3)	(3)	68.9	56.5	46.2	44.3	39.4	39.5
New Mexico	(3)	(3)	(3)	145.4	129.3	121.8	123.7	108.7
New York	99.3	86.3	67.6	58.8	48.0	47.0	45.1	40.6
North Carolina	(3)	84.9	78.8	78.6	68.8	68.9	65.5	68.6
North Dakota	(3)	(3)	71.6	61.7	59.4	49.7	52.4	49.8
Ohio	(3)	82.9	69.6	60.7	50.4	51.2	49.6	43.3
Oklahoma	(3)	(3)	(3)	60.7	54.6	60.0	56.6	49.0
Oregon	(3)	61.8	51.1	50.0	41.2	44.3	41.5	39.2
Pennsylvania	109.8	97.1	82.0	68.0	50.8	51.2	50.3	45.9
Rhode Island	120.3	(3)	72.8	61.8	47.2	48.2	47.6	43.8
South Carolina	(3)	115.8	(3)	88.7	79.3	80.8	75.6	80.3
South Dakota	(3)	(3)	(3)	(3)	52.5	47.8	51.1	43.8
Tennessee	(3)	(3)	(3)	75.7	64.0	68.5	61.1	63.5
Texas	(3)	(3)	(3)	(3)	71.7	71.2	73.9	65.1
Utah	(3)	71.4	55.8	57.4	49.3	52.7	41.4	46.8
Vermont	85.5	96.2	72.4	64.8	48.6	58.0	49.5	48.4
Virginia	(3)	83.6	80.8	77.3	69.6	73.9	69.7	66.2
Washington	(3)	66.4	56.4	48.7	45.2	45.4	39.9	38.7
West Virginia	(3)	(3)	79.8	81.0	60.6	71.2	61.8	62.3
Wisconsin	(3)	76.5	67.2	55.7	46.0	47.7	43.4	41.8
Wyoming	(3)	(3)	63.9	69.3	51.1	57.6	55.6	51.8

[1] Vital Statistics—Special Reports, Bureau of the Census, Department of Commerce, vol. 9, No. 15 (Jan. 19, 1940).
[2] In continental United States.
[3] Not in the birth registration area.

certain population groups and in certain localities. In 1 State the rate is still over 108, though it has decreased from 145 in 1930. The next highest rate for 1938 is 98.8, while 11 other States have rates over 60. The lowest rate is 36.3, although only 6 other States have a rate under 40.

These figures represent a great accomplishment in public health work during the past 25 years in reducing infant mortality, in which the reduction in the number of deaths from diarrhea and enteritis has been an important factor. The death rates for other causes, however, such as premature birth, injury at birth, and even bronchitis and pneumonia, have been reduced very little during that period. There are still hazards of birth and early infancy that are amenable to control; and there are still groups of our population for which better facilities should be provided and greater effort expended in the conservation of infant lives.

THE AMERICAN SOCIAL HYGIENE ASSOCIATION, 1939

The year 1939 marked the twenty-sixth year of national service by the American Social Hygiene Association. This voluntary health organization, founded in 1914 by merging existing national organizations in the field, and with President Charles W. Eliot of Harvard University as its first president, first led the battle against the venereal diseases and has played an important role in changing the policy of silence and inaction to one of public and frank attack on these diseases.

The American Social Hygiene Association conducts its activities of venereal disease control in various fields, and closely cooperates with official agencies. It directs special efforts toward informing the citizens, mobilizing effective local voluntary units, encouraging the passage and enforcement of laws designed to prevent and control venereal disease, giving consultant services—medical, public health, and legal—and improving sex education in schools.

In 1939 the Association aided in 5,000 Social Hygiene Day meetings, secured the printing of 20,000 news stories, editorials, or other items in papers and magazines, distributed 1,245,000 pamphlets, 5,554 books, and 48,540 charts and posters, and sponsored and distributed films that were shown to audiences aggregating over a million people.

In mobilizing the citizens for the fight against venereal diseases, 15 members of the Association traveled 130,000 miles into 500 counties of 48 States, increased the number of local social hygiene groups from 145 to 159, and increased its own paid membership by 37 percent over the number in 1938, the best previous year in this respect.

The Association has actively encouraged and promoted the passage of laws requiring premarital examinations and blood tests of expectant mothers, 9 additional States being added to the first category in 1939 and 14 to the latter. The legal staff gave aid and counsel to numerous State and local groups regarding social hygiene legislation and compiled a 400-page summary of venereal disease control legislation in the 48 States.

The consultants of the medical staff conducted a study of the distribution, use, and value of Federal assistance to States and cities for venereal disease control, visited hospitals on Indian reservations, and gave lectures in cooperation with medical and nursing societies. Support has been given to significant research in the urgent basic medical problems of syphilis and gonorrhea.

The program of the American Social Hygiene Association fits in with and supplements the Federal program. The funds for the latter go for the improvement and expansion of local official health services in the fight against the venereal diseases, whereas the Association engages in activities in fields more suitable for effective voluntary organization.

Requests upon the Association for services far exceed the financial ability to meet them all. Its modest budget of $220,000 for 1940 seems small in comparison with the immensity of the task to be done. "We have made no more than an energetic beginning in a war that should enlist the sympathy and active cooperation of every community."

Any one interested in the specific activities of the Association during 1939 may obtain such information by requesting a copy of "How Social Hygiene Reached Out to Millions in 1939" from the American Social Hygiene Association, 50 West Fiftieth Street, New York, N. Y.

EIGHTH AMERICAN SCIENTIFIC CONGRESS

Washington, D. C., May 10–18, 1940

The Eighth American Scientific Congress which will convene in Washington, D. C., May 10–18, 1940, will not only serve as a forum for the scientific thought of the Western Hemisphere, but it will signalize the fiftieth anniversary of the founding of the Pan American Union. All American republics, members of the Pan American Union, have been invited, and are expected to participate.

The first scientific congress of international scope in the history of the Western Hemisphere was held in Buenos Aires in 1898, in connection with the celebration of the Silver Jubilee of the Argentine Scientific Society. It was through the initiative and enlightened cooperation of scientists and officials of the Argentine Republic that there was

conceived and executed the plan of calling together periodically the scientists of other American countries for discussion and exchange of ideas regarding problems of mutual interest.

The Pan American Union, the semicentennial of which is being memorialized as a part of the program of the Congress, was designed primarily to serve as the agency for collecting, tabulating, and publishing information concerning commercial production and concerning the laws and regulations of the respective member nations. The scope of the activities of the Union has been increased, however, to include virtually every phase of human activity, scientific, economic, juridical, cultural, and social, and it has been an effective agent in promoting cordial relations between the nations of the Western Hemisphere.

The agenda for the Eighth American Scientific Congress will include eleven sections, as follows:

I. Anthropological Sciences; II. Biological Sciences; III. Geological Sciences; IV. Agriculture and Conservation; V. Public Health and Medicine; VI. Physical and Chemical Sciences; VII. Statistics; VIII. History and Geography; IX. International Law, Public Law, and Jurisprudence; X. Economics and Sociology; and XI. Education.

Of especial interest to health officers and other persons concerned with public health will be the program of Section V, Public Health and Medicine, of which Surgeon General Parran is chairman. The tentative outline of the program of this section, with key topics and subtopics for each session, already arranged or anticipated, is as follows:

SATURDAY, MAY 11, A. M.:

General topic: *Education.*

The bearing of popular, higher, professional, and special education upon medicine and public health. (Joint session with Section on Education.)

MONDAY, MAY 13, P. M.:

General topic: *Nutrition.*

Summaries on status of recognized avitaminoses. Relation between nutritive state and some aspects of heart disease. Relation between drinking water and dental caries and mottled enamel. Recent observations on ariboflavinosis.

TUESDAY, MAY 14, A. M.: Joint session with Statistical Section.

P. M.: Visit to National Institute of Health. Observation of current investigations in many branches. Visitors may concentrate, if they desire, on subjects of personal professional interest.

WEDNESDAY, MAY 15, A. M.:

General topic: *Tuberculosis.*

Social and economic factors in etiology. Changes in clinical types encountered. Constitution of tubercle bacillus and its antigenic fractions. An epidemiological paradox of tuberculosis and possible explanations. New methods of treatment.

P. M.

General topic: *Chemotherapy.*

Chemistry and pharmacology of new compounds. Clinical applications to infections with streptococci, gonococci, pneumococci, meningococci, to lymphogranuloma venereum, and other infections. Experimental results of promise.

THURSDAY, MAY 16, A. M.:

General topic: *Heart Disease.*

New conceptions from clinical viewpoint. Epidemiological features of rheumatic heart disease. Incidence and importance of etiologic forms of heart disease. Physiologic considerations of resuscitation.

P. M.

General topic : *Cancer.*

Present status of experimental cancer. Organization for cancer study and control. Newer aspects of therapy.

FRIDAY, MAY 17, A. M.:

General topic: *Tropical and other diseases.*

Summaries and new contributions on yellow fever, pinto, leprosy, undulant fever, rickettsial diseases, plague.

DEATHS DURING WEEK ENDED MARCH 16, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Mar. 16, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,960	9,544
Average for 3 prior years	9,304	
Total deaths, first 11 weeks of year	105,008	104,790
Deaths under 1 year of age	426	565
Average for 3 prior years	566	
Deaths under 1 year of age, first 11 weeks of year	5,732	6,122
Data from industrial insurance companies:		
Policies in force	66,021,448	67,772,489
Number of death claims	13,652	18,305
Death claims per 1,000 policies in force, annual rate	10.8	14.1
Death claims per 1,000 policies, first 11 weeks of year, annual rate	10.7	10.9

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MARCH 30, 1940

Summary

For the current week, the influenza incidence again declined, with 4,087 cases reported, as compared with 4,438 for the preceding week and with a 5-year (1935–39) median of 4,770 cases. The highest incidence has been persistently maintained in the South Atlantic and South Central groups of States.

As compared with the preceding week, slight increases were shown for measles, scarlet fever, and whooping cough, although all of the 9 diseases remained below the median expectancy based on the experience of the 5 years 1935–39. The accumulated totals for the first 13 weeks of the current year of all of these diseases except influenza and poliomyelitis are also below the median totals of the preceding 5 years. The total number of smallpox cases reported this year to date is approximately one-fourth of the median expectancy, measles about one-half, meningococcus meningitis less than one-third, and typhoid fever about two-thirds of the expectancy.

Of a total of 19 cases of poliomyelitis reported for the current week, 4 cases occurred in Texas and 3 cases each in California and Utah, while no more than 1 case was reported from any other State.

Three cases of Rocky Mountain spotted fever were reported in the Mountain States and 2 cases of brucellosis (undulant fever) were reported in Maryland during the current week.

Telegraphic morbidity reports from State health officers for the week ended March 30, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 30, 1940	Apr. 1, 1939		Mar. 30, 1940	Apr. 1, 1939		Mar. 30, 1940	Apr. 1, 1939		Mar. 30, 1940	Apr. 1, 1939	
NEW ENG.												
Maine	7	1	1	4	22	13	424	31	132	0	1	0
New Hampshire	0	0	0	------	------	------	144	0	43	0	0	0
Vermont	0	0	0	------	------	------	9	43	43	0	0	0
Massachusetts	2	3	3	------	------	------	359	1,008	632	1	2	2
Rhode Island	0	1	0	------	------	------	158	9	120	0	0	1
Connecticut	0	0	4	6	7	9	134	717	707	0	1	1
MID. ATL.												
New York	16	14	27	[1] 15	[1] 41	[1] 22	560	1,467	2,867	2	4	8
New Jersey [2]	10	6	16	16	5	19	461	55	1,338	0	0	2
Pennsylvania	25	35	38	------	------	------	215	119	1,337	7	5	5
E. NO. CEN.												
Ohio	3	37	33	97	------	20	25	32	584	2	2	8
Indiana	6	6	14	27	84	55	10	9	137	3	0	6
Illinois	19	36	36	33	73	52	82	33	106	2	1	4
Michigan [3]	3	20	12	3	243	6	318	393	393	0	2	2
Wisconsin	0	0	1	202	544	59	292	562	562	0	2	1
W. NO. CEN.												
Minnesota	2	0	4	3	14	1	214	708	394	0	0	1
Iowa	2	7	7	9	156	8	341	160	160	0	0	1
Missouri [2]	2	11	16	1	27	110	7	5	41	0	0	2
North Dakota	1	2	1	6	149	9	1	44	19	0	0	0
South Dakota	2	1	0	1	33	0	1	171	4	0	1	0
Nebraska	3	4	8	------	2	0	58	214	80	0	0	0
Kansas	0	4	5	4	66	23	580	37	37	1	1	1
SO. ATL.												
Delaware	0	0	0	------	------	------	0	0	15	0	0	0
Maryland [3]	2	3	5	41	67	57	4	589	204	1	1	6
Dist. of Col.	3	1	11	8	2	2	0	124	52	1	0	2
Virginia	6	19	16	484	930	------	203	421	421	1	1	7
West Virginia [2]	5	9	10	138	512	67	17	18	52	2	0	4
North Carolina	22	11	11	57	37	87	145	808	271	1	0	1
South Carolina	3	6	5	455	1,265	533	3	57	38	1	2	1
Georgia [2]	8	8	7	90	1,086	336	155	172	0	1	2	2
Florida	8	4	4	13	25	25	193	186	57	2	0	1
E. SO. CEN.												
Kentucky	6	8	8	64	259	102	71	30	151	2	1	9
Tennessee	2	11	11	153	424	132	66	82	82	3	2	4
Alabama [2]	10	2	5	231	2,502	674	130	175	175	8	2	3
Mississippi [2]	12	3	4	------	------	------	------	------	------	0	3	1
W. SO. CEN.												
Arkansas	6	1	1	254	697	130	12	78	78	1	2	2
Louisiana [2]	7	11	12	31	11	34	32	189	99	0	1	1
Oklahoma	7	7	5	197	343	162	7	260	111	1	0	1
Texas [2]	26	24	88	1,154	2,440	436	789	393	393	1	2	3
MOUNTAIN												
Montana [4]	1	2	2	43	198	22	35	166	22	0	0	0
Idaho	2	0	0	------	76	11	39	222	18	0	0	1
Wyoming [4]	1	4	2	------	1	1	37	151	28	0	0	0
Colorado	5	8	8	11	30	------	27	272	272	0	0	0
New Mexico	0	3	3	1	101	19	53	26	87	0	0	1
Arizona	5	2	2	137	391	64	104	30	30	0	0	0
Utah [3]	0	1	0	13	95	------	417	150	24	0	0	0
PACIFIC												
Washington	1	1	1	------	------	1	891	703	190	0	1	0
Oregon	9	2	1	28	79	69	620	58	58	1	1	0
California	14	19	23	62	553	417	444	4,154	1,046	2	1	5
Total	274	358	453	4,087	13,590	4,770	8,887	15,331	15,331	42	44	173
13 weeks	4,942	6,566	7,754	149,029	113,646	99,074	76,869	167,831	167,831	520	682	1,652

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 30 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Mar. 30, 1940	Apr. 1, 1939		Mar. 30, 1940	Apr. 1, 1939		Mar. 30, 1940	Apr. 1, 1939		Mar. 30, 1940	Apr. 1, 1939	
NEW ENG.												
Maine	0	0	0	15	20	20	0	0	0	0	9	2
New Hampshire	0	0	0	1	7	10	0	0	0	0	0	0
Vermont	0	0	0	9	15	15	0	0	0	2	0	0
Massachusetts	0	0	0	163	171	287	0	0	0	0	2	1
Rhode Island	0	0	0	17	0	29	0	0	0	0	1	0
Connecticut	0	0	0	106	86	116	0	0	0	2	0	1
MID. ATL.												
New York	0	1	1	994	748	997	0	3	0	9	5	5
New Jersey [2]	0	0	0	448	181	221	0	0	0	1	0	3
Pennsylvania	1	0	1	548	373	571	0	6	0	7	8	5
E. NO. CEN.												
Ohio	1	0	1	431	732	440	3	25	0	5	2	2
Indiana	0	0	0	252	202	202	5	40	10	0	3	2
Illinois	1	1	1	857	483	861	3	18	18	3	9	5
Michigan [3]	0	0	1	310	562	522	0	18	9	6	2	2
Wisconsin	0	0	0	145	186	304	3	4	6	0	1	1
W. NO. CEN.												
Minnesota	0	0	0	80	107	158	2	15	13	1	0	1
Iowa	1	0	0	75	112	209	23	34	34	1	0	0
Missouri [2]	0	0	0	29	83	182	2	26	26	2	0	0
North Dakota	0	0	0	5	15	31	3	3	5	3	1	0
South Dakota	0	0	0	13	14	23	1	7	7	0	0	0
Nebraska	0	0	0	19	44	44	3	11	11	0	0	0
Kansas	0	0	0	63	109	138	0	12	12	0	0	0
SO. ATL.												
Delaware	0	0	0	10	9	9	0	0	0	0	0	0
Maryland [3]	0	0	0	38	40	74	0	0	0	2	2	3
Dist. of Col.	0	0	0	18	21	21	0	0	0	0	0	0
Virginia	0	0	0	32	22	54	0	0	0	2	5	4
West Virginia [3]	1	0	0	41	42	61	0	0	0	2	4	4
North Carolina	0	0	0	33	30	30	0	0	0	2	1	3
South Carolina	0	0	0	5	4	5	0	0	0	3	0	1
Georgia [3]	0	0	0	20	18	13	3	1	1	0	4	3
Florida	1	1	0	8	8	8	1	0	0	2	4	2
E. SO. CEN.												
Kentucky	0	0	0	111	63	57	0	3	1	2	3	3
Tennessee	0	0	0	94	67	27	0	10	1	1	3	2
Alabama [3]	0	0	0	18	9	9	1	4	1	3	3	3
Mississippi [3]	1	0	0	7	4	10	0	0	0	2	2	2
W. SO. CEN.												
Arkansas	0	0	0	4	5	10	1	3	2	1	1	1
Louisiana [3]	0	0	0	19	7	10	0	1	1	6	28	15
Oklahoma	0	0	0	11	33	24	3	40	1	0	1	2
Texas [3]	4	0	2	37	57	75	5	40	13	5	5	6
MOUNTAIN												
Montana [4]	1	0	0	29	19	19	0	5	5	3	0	1
Idaho	0	0	0	14	8	11	0	3	3	0	1	1
Wyoming [4]	0	0	0	4	7	17	0	1	2	0	0	0
Colorado	0	0	0	44	34	71	7	7	7	0	0	0
New Mexico	0	0	0	22	11	17	0	0	1	3	0	0
Arizona	1	0	0	14	3	5	0	9	0	0	1	1
Utah [2]	3	0	0	12	23	47	0	0	0	0	0	0
PACIFIC												
Washington	0	0	0	24	57	45	0	2	15	1	0	2
Oregon	0	0	0	20	18	38	1	20	12	0	8	1
California	3	0	3	149	195	218	2	17	9	4	2	4
Total	19	3	24	5,416	5,064	7,609	72	392	328	86	121	128
13 weeks	353	187	277	61,523	68,971	88,382	954	4,902	3,982	1,002	1,527	1,527

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 30, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough — Week ended Mar. 30, 1940	Whooping cough — Week ended Apr. 1, 1939
NEW ENG.		
Maine	33	70
New Hampshire	10	0
Vermont	84	42
Massachusetts	150	228
Rhode Island	8	101
Connecticut	25	83
MID. ATL.		
New York	319	506
New Jersey [2]	82	459
Pennsylvania	380	849
E. NO. CEN.		
Ohio	223	209
Indiana	41	33
Illinois	118	831
Michigan [3]	120	174
Wisconsin	97	201
W. NO. CEN.		
Minnesota	27	49
Iowa	7	12
Missouri [2]	4	12
North Dakota	27	0
South Dakota	2	1
Nebraska	9	9
Kansas	17	8
SO. ATL.		
Delaware	16	2
Maryland [3]	174	19
Dist. of Col.	7	85
Virginia	32	52
West Virginia [3]	69	27
SO. ATL.—continued		
North Carolina	69	286
South Carolina	15	111
Georgia [2]	28	51
Florida	20	35
E. SO. CEN.		
Kentucky	50	20
Tennessee	36	46
Alabama [2]	33	54
Mississippi [3]	---------	---------
W. SO. CEN.		
Arkansas	18	31
Louisiana [2]	25	2
Oklahoma	3	4
Texas [2]	243	130
MOUNTAIN		
Montana [4]	1	2
Idaho	25	4
Wyoming [4]	5	2
Colorado	5	57
New Mexico	31	12
Arizona	29	11
Utah [3]	105	85
PACIFIC		
Washington	38	19
Oregon	24	9
California	258	177
Total	8,092	4,110
13 weeks	37,830	54,751

[1] New York City only.
[2] Typhus fever, week ended March 30, 1940, 11 cases as follows: New Jersey, 1; Missouri, 1; Georgia, 2; Alabama, 2; Louisiana, 1; Texas, 4.
[3] Period ended earlier than Saturday.
[4] Rocky Mountain spotted fever, week ended March 30, 1940, 3 cases as follows: Montana, 1; Wyoming, 2.

WEEKLY REPORTS FROM CITIES

City reports for week ended March 16, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	155	678	125	7,983	923	2,444	31	399	22	1,234	--------
Current week [1]	73	321	66	1,837	496	1,869	2	379	14	866	--------
Maine:											
Portland	0	------	0	50	1	0	0	0	0	6	28
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	14
Manchester	0	------	0	25	0	0	0	0	0	0	15
Nashua	0	------	0	62	6	0	0	0	0	0	8
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	0	12
Rutland	0	------	0	0	1	0	0	0	0	0	6
Massachusetts:											
Boston	0	------	1	31	6	21	0	10	1	45	212
Fall River	0	------	0	35	1	1	0	1	0	2	33
Springfield	0	------	0	0	0	9	0	0	0	20	35
Worcester	0	------	0	3	6	8	0	1	0	0	50
Rhode Island:											
Pawtucket	0	------	0	0	0	1	0	0	0	0	11
Providence	0	------	0	112	6	10	0	1	0	5	62
Connecticut:											
Bridgeport	0	------	0	0	2	3	0	1	0	0	31
Hartford	0	------	0	1	0	9	0	0	0	5	35
New Haven	0	4	0	1	1	1	0	0	0	2	43
New York:											
Buffalo	0	------	0	3	8	18	0	6	0	3	130
New York	17	33	5	70	95	647	0	91	1	110	1,585
Rochester	0	2	0	2	1	20	0	0	0	11	51
Syracuse	0	------	0	0	7	12	0	2	0	8	62
New Jersey:											
Camden	0	------	1	0	3	11	0	0	0	1	27
Newark	0	3	0	139	4	18	0	12	0	11	111
Trenton	0	1	2	0	2	3	0	0	1	2	50
Pennsylvania:											
Philadelphia	4	10	3	20	19	79	0	29	3	51	523
Pittsburgh	0	4	3	1	9	27	0	5	0	2	176
Reading	0	------	0	0	2	0	0	0	0	10	14
Scranton	1	------	------	0	------	2	0	------	0	0	------
Ohio:											
Cincinnati	0	1	0	2	7	15	0	8	0	17	145
Cleveland	1	48	2	2	11	21	0	10	1	18	219
Columbus	1	2	2	1	9	7	0	1	0	12	107
Toledo	0	1	1	1	8	23	0	3	1	12	78
Indiana:											
Anderson	0	------	0	0	0	1	0	0	0	3	11
Fort Wayne	0	------	1	0	2	1	0	4	0	1	32
Indianapolis	2	------	0	5	13	20	0	7	0	10	108
Muncie	0	------	0	0	4	2	0	0	0	0	19
South Bend	0	------	0	0	2	1	0	0	0	2	13
Terre Haute	0	------	0	0	0	1	0	0	0	2	11
Illinois:											
Alton	0	------	0	0	0	0	0	1	1	0	16
Chicago	5	10	2	25	38	492	0	38	0	43	727
Elgin	0	------	0	0	0	3	0	0	0	0	7
Moline	0	------	0	0	0	2	0	0	0	0	14
Springfield	0	------	0	1	3	2	0	0	0	0	26
Michigan:											
Detroit	1	3	0	28	16	71	0	7	1	11	278
Flint	0	------	0	0	4	10	0	0	0	15	21
Grand Rapids	0	------	0	5	2	17	0	1	0	6	36
Wisconsin:											
Kenosha	0	------	0	4	0	0	0	0	0	0	11
Madison	0	------	1	1	0	4	0	0	0	8	15
Milwaukee	0	------	0	6	7	27	0	2	0	8	123
Racine	0	------	0	0	0	2	0	0	0	0	10
Superior	0	------	0	79	0	5	0	0	0	0	5

[1] Figures for Barre, Boise, Tacoma, and San Francisco estimated; reports not received.

City reports for week ended March 16, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	132	1	5	0	0	0	1	25
Minneapolis	4	------	1	2	6	31	0	0	0	6	106
St. Paul	0	1	1	0	8	8	0	2	0	7	77
Iowa:											
Cedar Rapids	0	------	------	8	------	1	0	------	0	6	------
Davenport	1	------	------	3	------	5	0	------	0	0	------
Des Moines	1	------	0	6	0	4	3	0	0	0	39
Sioux City	0	------	------	0	------	0	0	------	0	0	------
Waterloo	1	------	------	0	------	0	0	------	0	0	------
Missouri:											
Kansas City	0	1	1	1	3	17	0	8	0	1	91
St. Joseph	0	------	6	0	1	0	0	1	0	1	24
St. Louis	3	1	1	1	9	30	0	5	0	7	204
North Dakota:											
Fargo	0	------	0	2	0	0	0	0	0	0	6
Grand Forks	0	------	------	0	------	0	0	------	0	1	------
Minot	0	------	0	1	0	0	0	0	0	0	6
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	0	------
Sioux Falls	0	------	0	0	0	1	0	0	0	0	9
Nebraska:											
Lincoln	1	------	------	0	------	2	0	------	0	2	------
Omaha	0	------	0	5	7	1	0	0	0	0	49
Kansas:											
Lawrence	0	7	0	0	1	0	0	0	0	0	4
Topeka	0	------	0	1	6	3	0	1	0	0	27
Wichita	4	2	0	241	3	2	0	0	0	2	39
Delaware:											
Wilmington	0	------	0	2	2	6	0	0	0	1	24
Maryland:											
Baltimore	1	25	2	1	23	12	0	19	0	181	222
Cumberland	0	------	0	0	0	0	0	0	0	0	12
Frederick	0	------	0	0	0	0	0	0	0	0	3
Dist. of Col.:											
Washington	6	1	1	5	9	18	0	11	0	15	153
Virginia:											
Lynchburg	0	------	0	0	5	0	0	1	0	12	16
Norfolk	0	12	0	2	7	2	0	0	0	9	37
Richmond	1	------	2	0	3	2	0	3	0	0	42
Roanoke	0	------	0	0	1	3	0	0	0	0	21
West Virginia:											
Charleston	0	------	0	0	1	0	0	2	0	0	28
Huntington	0	------	------	0	------	1	0	------	0	0	------
Wheeling	0	------	0	0	3	1	0	1	0	1	27
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	0	0	0	2	0	0	12
Wilmington	0	------	0	0	1	0	0	0	0	0	9
Winston-Salem	0	------	0	0	1	1	0	1	1	3	16
South Carolina:											
Charleston	1	46	1	0	0	1	0	0	0	0	28
Florence	0	------	0	0	4	0	0	0	0	0	17
Greenville	0	------	0	0	7	1	0	2	0	0	34
Georgia:											
Atlanta	1	18	3	3	6	1	0	3	0	1	92
Brunswick	0	------	0	0	0	0	0	1	0	0	5
Savannah	2	15	3	0	3	0	0	2	0	0	33
Florida:											
Miami	0	7	0	0	1	0	0	4	0	0	47
Tampa	0	------	0	122	1	2	0	1	0	2	32
Kentucky:											
Ashland	0	6	0	0	2	0	0	0	0	1	8
Covington	0	------	0	1	2	3	0	3	0	0	16
Lexington	0	------	0	0	0	1	0	0	0	1	17
Louisville	0	1	0	0	12	26	0	0	0	39	77
Tennessee:											
Knoxville	0	12	1	1	2	12	0	1	0	0	23
Memphis	0	5	0	4	3	21	1	2	2	12	66
Nashville	1	------	1	8	9	6	0	2	0	6	58
Alabama:											
Birmingham	1	9	1	3	6	1	0	2	0	0	63
Mobile	0	5	8	0	1	1	0	0	0	0	21
Montgomery	1	37	------	5	------	0	0	------	0	0	------
Arkansas:											
Fort Smith	0	12	------	0	------	0	0	------	0	0	------
Little Rock	0	1	0	0	6	0	0	0	0	0	7

City reports for week ended March 16, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Louisiana:											
Lake Charles	0		0	3	1	0	0	1	0	0	9
New Orleans	0	6	4	13	22	9	0	9	0	29	194
Shreveport	0		1	0	3	1	0	2	0	0	51
Oklahoma:											
Oklahoma City	0	3	0	0	7	0	0	1	0	0	48
Tulsa	0			0		1	0		0	18	
Texas:											
Dallas	3	9	4	27	8	3	0	3	0	21	66
Fort Worth	0		1	0	4	1	0	0	0	22	33
Galveston	1		0	4	4	2	0	0	1	0	15
Houston	1	3	0	3	4	4	0	4	0	1	92
San Antonio	1	4	6	55	9	1	0	5	0	2	77
Montana:											
Billings	0		0	0	1	0	0	1	0	0	15
Great Falls	0		0	1	2	2	0	0	0	0	10
Helena	0		0	0	0	0	0	0	0	0	3
Missoula	0	1	0	0	0	1	0	1	0	1	6
Idaho:											
Boise											
Colorado:											
Colorado Springs	0		0	1	3	2	0	0	0	0	11
Denver	3		4	7	11	6	0	3	0	2	93
Pueblo	0		0	0	0	4	0	0	0	1	3
New Mexico:											
Albuquerque	0		0	0	1	0	0	3	0	9	11
Utah:											
Salt Lake City	0		0	126	2	7	1	3	1	44	26
Washington:											
Seattle	0		0	349	2	7	0	2	0	24	105
Spokane	0		0	0	2	11	0	1	1	1	31
Tacoma											
Oregon:											
Portland	6	2	1	189	5	3	0	2	0	8	90
Salem	0			6		0	0		0	0	
California:											
Los Angeles	5	43	3	27	7	26	0	24	0	19	368
Sacramento	0	2	1	2	2	4	0	2	0	14	29
San Francisco											

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				Maryland:			
Boston	0	0	1	Baltimore	1	1	0
New York:				Virginia:			
New York	0	0	1	Norfolk	1	1	0
Ohio:				West Virginia:			
Cincinnati	1	0	0	Charleston	2	1	0
Columbus	0	1	0	Florida:			
Illinois:				Tampa	1	0	0
Chicago	2	0	0	Alabama:			
Michigan:				Birmingham	1	1	0
Detroit	3	0	0	Louisiana:			
Wisconsin:				New Orleans	1	0	1
Milwaukee	1	0	0	Shreveport	0	1	0

Dengue.—Cases: Charleston, S. C., 2.
Encephalitis, epidemic or lethargic.—Cases: Great Falls, 1.
Pellagra.—Cases: Winston-Salem, 1; Charleston, S. C., 2.
Typhus fever.—Cases: New York, 2; St. Louis, 1; Savannah, 2.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Weeks ended February 10, 17, and 24, 1940.—During the weeks ended February 10, 17, and 24, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Week ended February 10, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				3	1				1	5
Chickenpox		40		151	526	39	81	25	56	918
Diphtheria			1	7		14	1	1		24
Dysentery									6	6
Influenza		46			202	4			7	259
Lethargic encephalitis					1	1				2
Measles				231	533	225	3	1	43	1,036
Mumps				29	153	9	3	4		198
Pneumonia		3			61		4		13	81
Poliomyelitis						1				1
Scarlet fever		12	11	108	166	15	4	23	8	347
Trachoma									2	2
Tuberculosis	1	1	8	55	48	8	23	2		146
Typhoid and paratyphoid fever				12		2			1	15
Whooping cough		6	8	136	95	42	37	28	21	373

Week ended February 17, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				2	3				2	7
Chickenpox		11	2	208	459	34	36	8	85	838
Diphtheria			2	34	1	11	4	4		56
Dysentery				1						1
Influenza		130			12	2			27	171
Lethargic encephalitis								2		2
Measles		1	1	104	461	301	4	17	34	923
Mumps				30	370	18	105			523
Pneumonia		13			21	1			7	42
Poliomyelitis				1						1
Scarlet fever		7	4	97	123	32	9	30	16	318
Trachoma						1			2	3
Tuberculosis	1	14	15	72	61	2	3			168
Typhoid and paratyphoid fever			2	8	1			1		12
Whooping cough		10	2	134	133	16	25	8	14	342

Week ended February 24, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				1	2				1	4
Chickenpox		5		210	525	56	47	19	73	935
Diphtheria			4	14	3	21	3			45
Dysentery				1				1		2
Influenza		35			197	5			27	264
Measles		1		86	714	565	33	2	15	1,416
Mumps		1		71	430	21	46	2	3	574
Pneumonia	2	2			14	8			17	38
Poliomyelitis				1						1
Scarlet fever	1	19	12	97	137	12	4	14	2	208
Trachoma									1	1
Tuberculosis	1	6	9	91	57	4		1		169
Typhoid and paratyphoid fever				7	1	1	1			10
Whooping cough		3	5	117	91	26	37	22	18	319

Provinces—Vital statistics—Third quarter 1939.—The Bureau of Statistics of the Dominion of Canada has published the following preliminary statistics for the third quarter of 1939. The rates are computed on an annual basis. There were 20.2 live births per 1,000 population during the third quarter of 1939 as compared with 21.1 during the third quarter of 1938. The death rate was 8.3 per 1,000 population for the third quarter of 1939 and 8.7 for the corresponding quarter of 1938. The infant mortality rate was 53 per 1,000 live births for the third quarter of 1939 and 57 for the same quarter of 1938. The maternal death rate was 3.6 per 1,000 live births for the third quarter of 1939 and 4.3 for the corresponding quarter of 1938.

The accompanying tables give the numbers of births, deaths, and marriages, by Provinces, for the third quarter of 1939, and deaths by causes in Canada for the third quarter of 1939 and the corresponding quarter of 1938:

Numbers of births, deaths, and marriages, third quarter 1939

Province	Live births	Deaths (exclusive of stillbirths)	Deaths under 1 year of age	Maternal deaths	Marriages
Canada [1]	57,423	23,762	3,067	205	32,698
Prince Edward Island	566	204	34	5	193
Nova Scotia	2,778	1,117	138	6	1,463
New Brunswick	2,854	1,139	176	11	1,174
Quebec	19,737	7,481	1,426	83	10,841
Ontario	16,445	7,949	628	63	11,061
Manitoba	3,502	1,465	199	12	2,363
Saskatchewan	4,577	1,394	192	7	1,506
Alberta	3,865	1,274	164	12	2,089
British Columbia	3,099	1,739	110	6	2,508

[1] Exclusive of Yukon and the Northwest Territories.

Deaths, by cause, third quarter 1939

Cause of death	Canada [1] (third quarter)		Province								
	1938	1939	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
All causes		23,762	204	1,117	1,139	7,481	7,949	1,465	1,394	1,274	1,739
Automobile accidents	490	519	2	23	34	143	221	24	21	20	31
Cancer	3,104	3,066	16	167	128	868	1,104	211	177	136	259
Cerebral hemorrhage, cerebral embolism, and thrombosis	460	425	5	25	49	83	184	13	27	18	21
Diarrhea and enteritis	1,017	1,006	12	23	88	598	147	60	38	33	7
Diphtheria	93	68			12	41	3	2	8	2	
Diseases of the arteries	2,231	2,296	15	89	101	457	1,037	165	127	131	174
Diseases of the heart	3,671	3,931	35	201	152	921	1,584	241	251	224	322
Homicides	32	37	1		2	5	10	2	7	3	7
Influenza	214	185	2	16	3	75	45	8	14	14	8
Measles	44	27			4	16	7				
Nephritis	1,383	1,367	14	62	45	641	378	48	49	49	81
Pneumonia	1,025	783	8	35	48	194	264	60	60	51	63
Poliomyelitis	41	24	1			4	12	2		3	2
Puerperal causes	256	205	5	6	11	83	63	12	7	12	6
Scarlet fever	27	17			1	7	4		2	3	
Suicide	235	253	1	9	3	43	94	20	31	20	32
Tuberculosis	1,447	1,376	13	87	64	622	276	71	46	57	140
Typhoid and paratyphoid fever	57	46		1	5	28	6	2		2	2
Unspecified or ill-defined causes		127	3	8	30	50	11	5	2	12	6
Violence	1,400	1,388	10	47	57	394	456	94	104	94	132
Whooping cough	101	109		20	4	39	14	12	10	8	2
Other specified causes		6,507	61	293	298	2,169	2,029	413	413	332	444

[1] Exclusive of Yukon and the Northwest Territories.

CUBA

Habana—Communicable diseases—4 weeks ended March 9, 1940.—During the 4 weeks ended March 9, 1940, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	7		Tuberculosis	7	
Scarlet fever	1		Typhoid fever	21	2

Provinces—Notifiable diseases—4 weeks ended February 3, 1940.—During the 4 weeks ended February 3, 1940, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer		3	3	3	1	10	20
Chickenpox	1	9		1		1	12
Diphtheria	6	18		1	4		29
Dysentery		6					6
Hookworm disease				1			1
Leprosy		1			3	1	5
Malaria	8			4	22	39	73
Measles		19					19
Poliomyelitis		3		3	1		7
Scarlet fever		1					1
Tuberculosis	15	52	17	10	3	43	140
Typhoid fever	10	59	4	13	7	46	139

DENMARK

Notifiable diseases—October–December 1939.—During the months of October, November, and December 1939, cases of certain notifiable diseases were reported in Denmark as follows:

Disease	October	November	December	Disease	October	November	December
Cerebrospinal meningitis		9		Mumps	96	159	174
Chickenpox	510	1,130	1,036	Paratyphoid fever	8	3	9
Diphtheria	136	165	146	Poliomyelitis	16	4	2
Dysentery	29	16	21	Puerperal fever	22	28	13
Epidemic encephalitis	1	1		Scarlet fever	1,234	1,283	826
Erysipelas	363	358	253	Syphilis	51	72	50
Gastroenteritis, infectious	1,515	1,300	1,024	Tetanus, neonatorum		2	3
German measles	141	151	163	Typhoid fever	1	1	3
Gonorrhea	764	675	639	Undulant fever	37	51	28
Influenza	5,722	6,074	5,699	Weil's disease	5	4	1
Malaria	1			Whooping cough	2,663	2,665	2,115
Measles	472	729	1,264				

FINLAND

Communicable diseases—4 weeks ended January 27, 1940.—During the 4 weeks ended January 27, 1940, cases of certain communicable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	316	Scarlet fever	440
Influenza	2,598	Typhoid fever	10
Paratyphoid fever	57	Undulant fever	2
Poliomyelitis	4		

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of March 29, 1940, pages 567–571. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Smallpox

Mexico.—During the month of December 1939, smallpox was reported in Mexico as follows: Mexico, D. F., 3 cases; Monterrey, Nuevo Leon State, 12 cases, 5 deaths; Reynosa, Tamaulipas State, 1 case.

Typhus Fever

Mexico.—During the month of December 1939, typhus fever was reported in Mexico as follows: Aguascalientes, Aguascalientes State, 1 case; Mexico, D. F., 9 cases, 3 deaths; Queretaro, Queretaro State, 1 case; San Luis Potosi, San Luis Potosi State, 6 cases, 1 death.

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Public Health Reports

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IN THIS ISSUE

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FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

February 25–March 23, 1940

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the PUBLIC HEALTH REPORTS under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended March 23, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935–39.

For the first time since this material has been presented in this way the incidence of all of the eight diseases was below the median expectancy for the 4-week period ended March 23.

Influenza.—The number of cases of influenza reported dropped from approximately 71,000 for the 4 weeks ended February 24 to approximately 33,000 for the 4 weeks ended March 23, a decline of more than 50 percent. The recent rise of this disease has been most perceptible in the South Atlantic, West South Central, and Pacific coast regions. During the week ended March 2 it was reported that there had been 10,035 cases of influenza in Madison County, Ind., since the first of the year, but other States in the East North Central group reported the normal seasonal incidence. The North Atlantic and West North Central regions apparently were not affected by the recent rise, the incidence in these regions being the lowest in recent years.

A comparison with recent years shows that the current incidence for the country as a whole was slightly more than 50 percent of the incidence during the corresponding period in 1939 and about 80 percent of the 1935–39 median figure for this period. Exceptions to the favorable picture for the whole country are seen in the East North Central and West South Central regions, where the numbers of cases for the current period were approximately twice the median expectancy, and minor increases were reported from the Mountain and Pacific regions; in all other regions the incidence was comparatively low.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period Feb 25–Mar 23, 1940, the number for the corresponding period in 1939, and the median number of cases reported for the corresponding period 1935–39 [1]

Division	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median
	Diphtheria			Influenza [2]			Measles [3]			Meningococcus meningitis		
United States [1]	1,273	1,724	2,104	33,101	63,297	41,476	30,322	62,298	62,298	172	201	646
New England	26	32	39	48	274	274	4,041	6,313	7,451	12	7	18
Middle Atlantic	176	333	375	245	638	319	3,164	6,611	14,303	42	44	93
East North Central	149	339	366	2,797	10,317	1,320	2,671	5,135	5,135	33	21	92
West North Central	141	115	169	518	7,357	1,301	4,500	6,092	6,092	4	11	43
South Atlantic	256	283	344	11,834	15,743	11,970	2,037	11,873	10,332	33	40	121
East South Central	165	115	157	2,777	11,404	10,134	1,255	1,680	1,680	19	27	73
West South Central	192	276	286	12,158	12,109	6,881	2,964	2,768	2,342	15	19	35
Mountain	71	81	81	1,185	4,314	791	2,725	3,501	3,501	7	17	19
Pacific	117	150	144	1,339	1,141	1,310	6,965	18,325	4,348	7	15	16
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States	74	51	78	20,341	21,157	30,157	309	1,320	1,290	299	515	423
New England	1	0	2	978	1,406	1,891	0	0	0	11	11	11
Middle Atlantic	8	3	8	7,013	5,405	7,038	0	0	0	41	68	57
East North Central	19	11	12	7,254	7,796	10,491	54	409	199	47	32	67
West North Central	2	2	6	1,441	2,308	3,711	89	240	597	26	22	24
South Atlantic	7	11	10	1,031	870	1,175	10	8	11	47	98	62
East South Central	7	7	9	768	634	519	8	30	8	34	31	31
West South Central	12	6	8	357	587	587	98	312	81	47	231	93
Mountain	5	5	3	541	627	857	33	78	100	19	16	19
Pacific	13	6	11	958	1,524	1,524	15	193	193	27	16	24

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 44 States and New York City.
[3] 47 States. Mississippi is not included.

Diphtheria.—For the 4 weeks ended March 23 there were 1,273 cases of diphtheria reported, as compared with 1,724, 2,104, and 1,776 for the corresponding period in 1939, 1938, and 1937, respectively. The incidence was relatively low all over the country, each section reporting an appreciable decline from the average expectancy.

Measles.—While the normal seasonal rise of measles occurred, the incidence continued at a comparatively low level. The number of cases (33,101) reported for the current period was only about 50 percent of the number recorded for the corresponding period in 1939 and about 80 percent of the 1935–39 median figure for the period. The only unfavorable incidence, as compared with recent years, occurred in the West South Central and Pacific regions; in the West South Central region the number of cases (2,964) was about 25 percent above the average seasonal level, while in the Pacific region the incidence (6,965 cases) was more than 60 percent above the normal seasonal incidence.

Meningococcus meningitis.—The incidence of meningococcus meningitis continued at a low level, the number of cases (172) reported for the 4 weeks ended March 23 being the lowest recorded for this period

in the 12 years for which these data are available. All regions participated in the low record.

Poliomyelitis.—The incidence of this disease (74 cases) was about 50 percent above that for the corresponding period in 1939, but it was slightly below the median level for the years 1935–39. For the first time since the 4-week period ended September 9, 1939, the number of cases for a 4-week period fell below the median expectancy for the corresponding period. The lowest incidence of this disease is usually reached during March or April.

Scarlet fever.—Scarlet fever incidence was also low, 20,341 cases for the current period, as compared with 21,157 for the corresponding period in 1939 and an average for recent years of approximately 30,000 cases. The East South Central region reported a few more cases than might normally be expected, but in all other regions the incidence was relatively low. For the country as a whole the current incidence is the lowest reported for this period in the 12 years for which these data are available.

Smallpox.—For smallpox, also, the comparison with recent years is favorable, the current incidence (302 cases) being the lowest on record for this period. Only one region, the West South Central, reported an excess over the expected seasonal incidence. The excess in that region was largely due to an increase of cases in Oklahoma, from 3 during the preceding 4 weeks to 71 cases for the 4 weeks ended March 23. The South Atlantic and East South Central regions reported about the normal incidence, while other regions reported very appreciable decreases from the 1935–39 median figures; the North Atlantic regions apparently remained free of the disease.

Typhoid fever.—Typhoid fever was also considerably below normal, 299 cases, as compared with 515 cases in 1939 and a median of 423 cases for the corresponding period in the years 1935–39. The incidence was significantly low in the Middle Atlantic, East North Central, South Atlantic, and West South Central regions; other regions reported about the normal seasonal incidence.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended March 23, based on data received from the Bureau of the Census, was 12.3 per 1,000 population (annual basis), as compared with 13.0, 12.2, and 13.1 for the corresponding period in the years 1939, 1938, and 1937, respectively. With the exception of the year 1938, a nonepidemic year for influenza, when the rate was 12.2, the current rate is the lowest for this period since 1933.

GEOGRAPHICAL DISTRIBUTION OF DIPHTHERIA MORTALITY IN THE UNITED STATES

By C. C. Dauer, *Epidemiologist, District of Columbia Health Department*

In 1920 approximately 150,000 cases of diphtheria were reported from 41 States, and nearly 14,000 deaths from this disease were registered in 35 States. In 1938 slightly more than 30,000 cases were reported from the entire country, while 2,600 deaths were registered. This constitutes a reduction of about 80 percent both in numbers of cases and deaths over a period of approximately two decades. Over this same period the mortality rate from diphtheria in the registration area declined 90 percent.

This decline in incidence and mortality has been accompanied by some definite changes in the geographical distribution of the disease. Mortality data from the States comprising the registration area previous to 1910 indicate that death rates from diphtheria in urban areas were considerably in excess of those for rural areas, the rates in 1910 being 25.0 and 16.0 per 100,000 population, respectively. In the past two decades this ratio gradually has been reversed so that in 1930 the rural rates in the registration area were slightly in excess. However, the registration area of 1910 was made up of a population predominantly urban, most of which was located in the northern and northeastern sections of the country. The registration area of 1910 had, in 1930, a diphtheria mortality rate in urban areas of 5.0 and a rural rate of 4.0.

Since 1910 there has been introduced into the registration area a population which has been predominantly rural in distribution, much of which has been located in the southern States where the decline in mortality has been slow. In 1920 many of the southern States had diphtheria death rates equally as high as those in the northern and northeastern sections, but, because of the slower rate of decline, the mortality is now considerably higher in the South. (See table 1.) This change in ratio of urban to rural mortality from diphtheria in the United States thus appears to have depended to a certain extent upon the introduction into the registration area of a predominantly rural population in which the decrease of mortality has been relatively slow as compared with other sections of the country.

One of the remarkable features about the occurrence of diphtheria in the United States has been the stability of the case fatality rates in the past two decades. This is all the more remarkable when the large amount of immunization given in this period is taken into consideration. As shown in table 1, for the two decades ending in 1938 there was no marked or consistent change in fatality rates within the various geographical sections, and, with few exceptions, in individual States. However, fatality rates have shown some variation when one

geographical section is compared with another. Fatality rates have been higher in certain southern and Mountain States than in other sections. These higher fatality rates probably reflect less complete reporting, but it is also conceivable that a high fatality rate may be the result of other factors, such as differences in virulence of the diphtheria organism, differences in the age distribution of cases, and quality and quantity of medical treatment. The operation of these three factors would be more probable in regions where the mortality rate is high.

In order to obtain a more accurate picture of the geographical distribution of diphtheria in the United States in recent years the numbers of deaths from this disease were obtained by counties for each State for two 5-year periods, 1929 to 1933 and 1934 to 1938, inclusive. The mortality rates per 100,000 population for each county are shown graphically on a map for each period (figs. 1 and 2). In this manner it is possible to demonstrate the areas of high and low mortality and also to show any changes in mortality during the 10-year period.

The data used in the preparation of these maps were obtained from vital statistics reports of certain States, from special tabulations furnished by State bureaus of vital statistics, and from the Division of Vital Statistics, Bureau of the Census. Deaths by place of usual residence were used when available. Rates were based on the 1930 census, using total populations. Mortality rates calculated on the basis of the population under 15 years of age would have been preferable if reasonably accurate estimates of population under 15 years could have been obtained for the 10-year period. There is no evidence that the general picture of the distribution would have been changed materially had age-specific rates been used.

The first map shows the average annual mortality rates for the period from 1929 to 1933, inclusive. The corresponding rate for the registration area was 4.9 for this period of years. The most conspicuous feature about the distribution of mortality was the large area of relatively high rates (two or more times higher than for the country as a whole) extending southwestward from Pennsylvania to Arizona. This extensive area embraced most of West Virginia, Kentucky, Tennessee, Arkansas, Oklahoma, Texas, and New Mexico. Fairly large groups of counties in certain bordering States were also located in this area of high mortality, particularly in southern Missouri, western Virginia and North Carolina, and northern Georgia, Alabama, and Mississippi. A few counties with high rates in other bordering States—Illinois, Indiana, Ohio, Pennsylvania, South Carolina, Louisiana, and Arizona—also must be included. South of the large area of high mortality, i. e., along the South Atlantic and Gulf coast lines, the average annual mortality rates for most of the counties were higher than the average for the sections north of the area.

TABLE 1.—*Average annual mortality rates and case fatality rates, by States, 1919–1938*

	Average annual mortality rates per 100,000 population				Case fatality rates, percent			
	1919–23	1924–28	1929–33	1934–38	1919–23	1924–28	1929–33	1934–38
New England	12.3	6.3	2.8	0.7	7.4	7.6	6.6	8.6
Maine	9.0	4.3	2.5	1.1	11.6	11.7	11.6	9.6
New Hampshire	11.5	5.6	2.6	.9	11.0	16.9	16.1	33.8
Vermont	8.0	4.7	1.7	.7	9.4	11.6	7.2	7.2
Massachusetts	15.2	8.0	3.6	.7	7.0	6.8	5.9	8.8
Rhode Island	15.5	7.9	4.4	.3	9.1	8.6	8.9	4.7
Connecticut	14.9	7.4	1.8	.8	6.6	7.3	5.5	7.2
Middle Atlantic	17.3	9.3	4.1	1.0	8.3	7.7	7.3	6.9
New York	15.4	8.1	2.7	.7	7.4	6.6	6.0	7.1
New Jersey	17.3	10.1	5.2	.9	8.0	7.7	7.6	5.6
Pennsylvania	19.2	9.7	4.5	1.4	9.6	8.9	8.6	7.2
East North Central	15.8	7.4	3.9	1.7	8.2	8.6	8.0	8.1
Ohio	13.3	6.9	2.9	2.0	7.0	7.2	6.8	7.6
Indiana	15.9	6.5	4.6	2.9	11.6	9.3	8.4	7.8
Illinois	17.0	7.2	5.4	1.8	7.7	8.8	7.9	8.2
Michigan	20.4	11.0	5.0	1.1	8.5	10.2	9.9	7.9
Wisconsin	12.6	5.5	1.9	.7	8.7	7.6	8.1	10.7
West North Central	12.5	5.2	3.2	1.6	6.2	8.0	7.6	7.1
Minnesota	9.7	5.1	1.5	.6	5.5	5.4	4.9	3.4
Iowa	9.8	4.6	2.1	1.2	(2)	13.0	10.1	8.0
Missouri	17.3	6.7	6.0	3.4	(2)	8.3	9.6	8.5
North Dakota	(1)	6.4	3.3	1.8	(2)	14.3	8.7	10.9
South Dakota	(1)	(1)	2.7	1.2	(2)	(2)	6.4	7.7
Nebraska	9.7	4.8	3.1	1.3	10.5	12.0	7.3	7.3
Kansas	16.1	3.7	3.6	1.8	5.8	6.1	7.5	7.3
South Atlantic	11.8	8.4	6.4	3.9	7.5	8.4	8.8	9.6
Delaware	11.3	8.0	5.9	1.2	11.6	14.2	9.6	5.4
Maryland	12.5	6.8	3.4	1.3	7.1	6.2	5.3	4.5
District of Columbia	14.9	7.0	4.8	3.3	(2)	(2)	5.6	4.5
Virginia	15.6	8.6	7.6	4.8	7.4	7.1	6.8	8.2
West Virginia	(1)	9.2	9.4	6.8	(2)	14.2	13.9	13.1
North Carolina	13.5	10.5	7.8	5.1	7.2	8.8	8.2	8.2
South Carolina	10.9	8.9	6.4	4.0	7.4	7.3	5.7	8.2
Georgia	(1)	7.8	6.1	4.8	(2)	(2)	16.6	13.2
Florida	7.1	7.8	4.6	3.6	10.7	11.4	13.1	12.4
East South Central	15.3	9.1	9.5	5.3	----------	24.1	14.4	14.4
Kentucky	18.4	10.2	11.9	6.6	(2)	35.6	20.9	17.3
Tennessee	14.1	9.9	9.9	5.7	(2)	19.0	14.2	14.9
Alabama	(1)	8.9	7.6	4.7	(2)	12.0	11.4	11.3
Mississippi	13.4	7.6	8.5	4.1	10.9	10.7	11.7	14.1
West South Central	----------	9.8	9.3	5.0	----------	----------	15.5	13.7
Arkansas	(1)	8.4	8.8	5.5	(2)	(2)	26.2	20.8
Louisiana	7.0	7.3	5.9	4.1	15.0	13.6	8.4	10.1
Oklahoma	(1)	(1)	13.2	4.7	(2)	(2)	16.7	19.5
Texas	(1)	(1)	(1)	5.7	(2)	(2)	(2)	12.2
Mountain	11.9	7.3	4.2	2.7	10.7	11.2	10.7	9.9
Montana	10.5	5.5	1.6	1.9	12.0	9.8	8.7	10.0
Idaho	10.3	5.6	2.5	1.3	(1)	12.0	9.8	12.0
Wyoming	8.1	5.8	2.0	1.8	(1)	15.3	11.3	12.0
Colorado	19.7	10.9	3.3	3.5	10.4	11.1	9.2	9.2
New Mexico	(1)	(1)	12.1	5.3	(2)	(2)	11.4	11.5
Arizona	(1)	5.7	7.0	5.9	(2)	(2)	12.2	12.2
Utah	10.9	10.1	2.2	1.0	(2)	(2)	(2)	4.3
Nevada	(1)	(1)	3.0	.8	(2)	(2)	16.6	7.3
Pacific	10.2	7.2	2.3	1.1	7.3	5.9	6.3	6.5
Washington	8.4	6.0	2.1	.6	8.8	7.3	7.5	8.6
Oregon	8.6	7.7	1.8	.8	7.3	6.9	8.2	8.7
California	13.7	7.8	3.1	1.9	7.1	5.5	6.0	6.3
Registration area	14.8	7.9	4.9	2.5	----------	----------	----------	----------

[1] Not in registration area.
[2] Data not available.

In other parts of the country, especially in the West North Central section and in certain Mountain States, some isolated counties

had high rates, i. e., 10.0 and over. In many instances these counties had small populations in which the occurrence of one or two deaths in the 5-year period naturally resulted in relatively high rates. In other parts of the country comparatively low mortality rates were to be found.

The map showing the average annual mortality rates for the 1934 to 1938 period shows a considerable amount of change from the preceding period. The rate for the registration area declined from 4.9 in the period 1929–33 to 2.5 in 1934–38. A large proportion of the counties located in the area of high mortality previously described showed a considerable decrease in mortality but this region still had rates well above that for the country as a whole. Relatively high rates, 10.0 and over, still were to be found in a fairly large number of counties located in West Virginia, Kentucky, Tennessee, and sections of Virginia, North Carolina, Missouri, Arkansas, Texas, and New Mexico. Along the South Atlantic seaboard the average rates, although lower than in the high rate region, were again higher than in the northern, northwestern and far western sections of the country. In these latter sections, where diphtheria mortality had been comparatively low in the 1929 to 1933 period, there was also a decline in rates equal to or greater than that in the high mortality region. Colorado and Montana showed a slight increase in rates over the preceding period, and Wyoming and Arizona had only a slight decrease, 10 and 16 percent, respectively. In Colorado a group of counties in the western part of the State had higher rates than previously, which appears to account for the increase in the rate for the State as a whole.

From the standpoint of epidemiology the unusual geographical distribution of diphtheria mortality in the United States during the past two decades is a problem of importance as well as of interest. It would be necessary before attempting to explain the wide differences in distribution to have specific information regarding certain factors for different sections of the country. Regional variations in the utilization of and accessibility to adequate medical care (serum therapy), in the amount of natural immunization (subclinical infections), in the extent of artificial immunization, in the incidence of carriers of virulent diphtheria bacilli, and in types or strains, virulence, and pathogenicity of the diphtheria bacillus, would have to be taken into consideration in attempting an explanation. However, data on these factors are either entirely lacking or too meager for such a purpose.

From the standpoint of public health administration it is encouraging that such a marked decrease in diphtheria mortality occurred in practically all sections of the country. Because of a lack of definite information, it cannot be determined to what extent this reduction

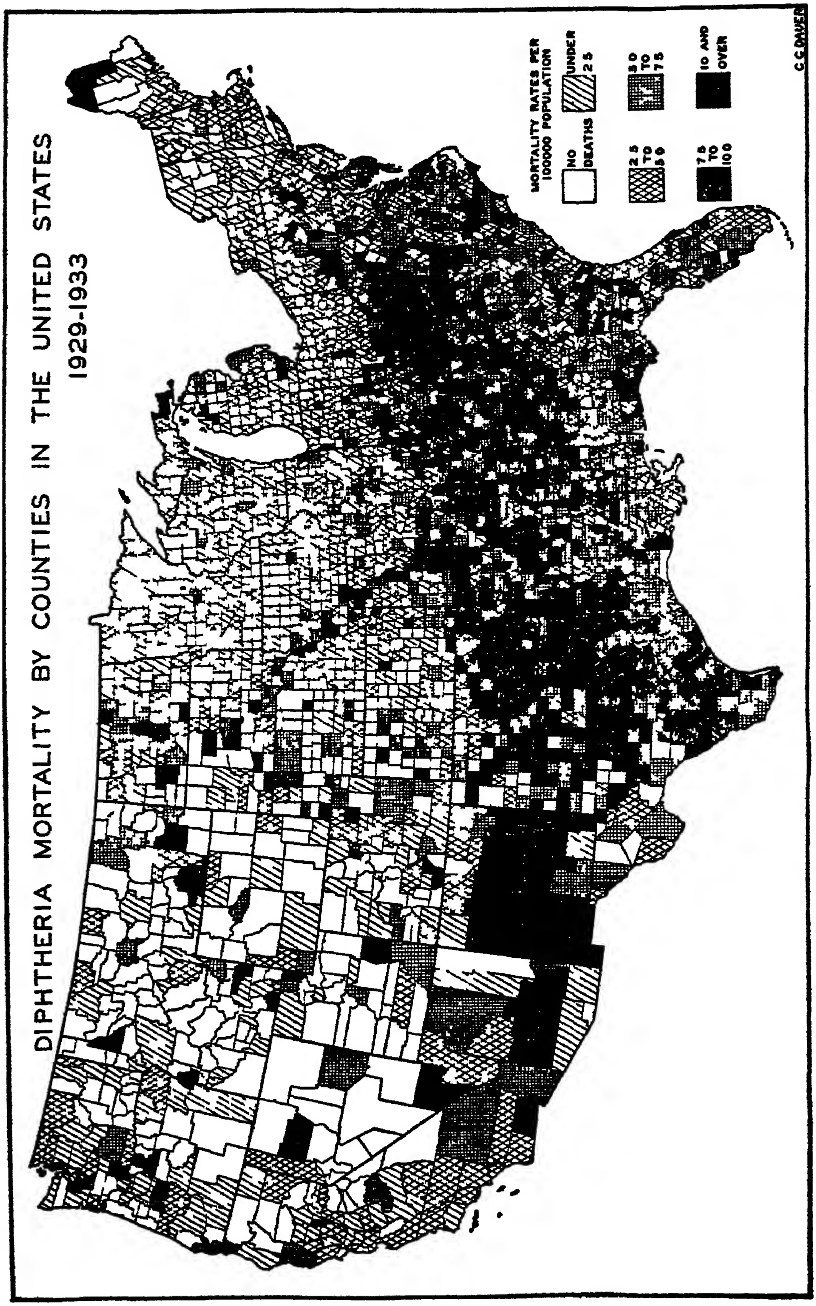

FIGURE 1.—Average annual mortality rates from diphtheria per 100 000 population, by counties in the United States, 1929–1933

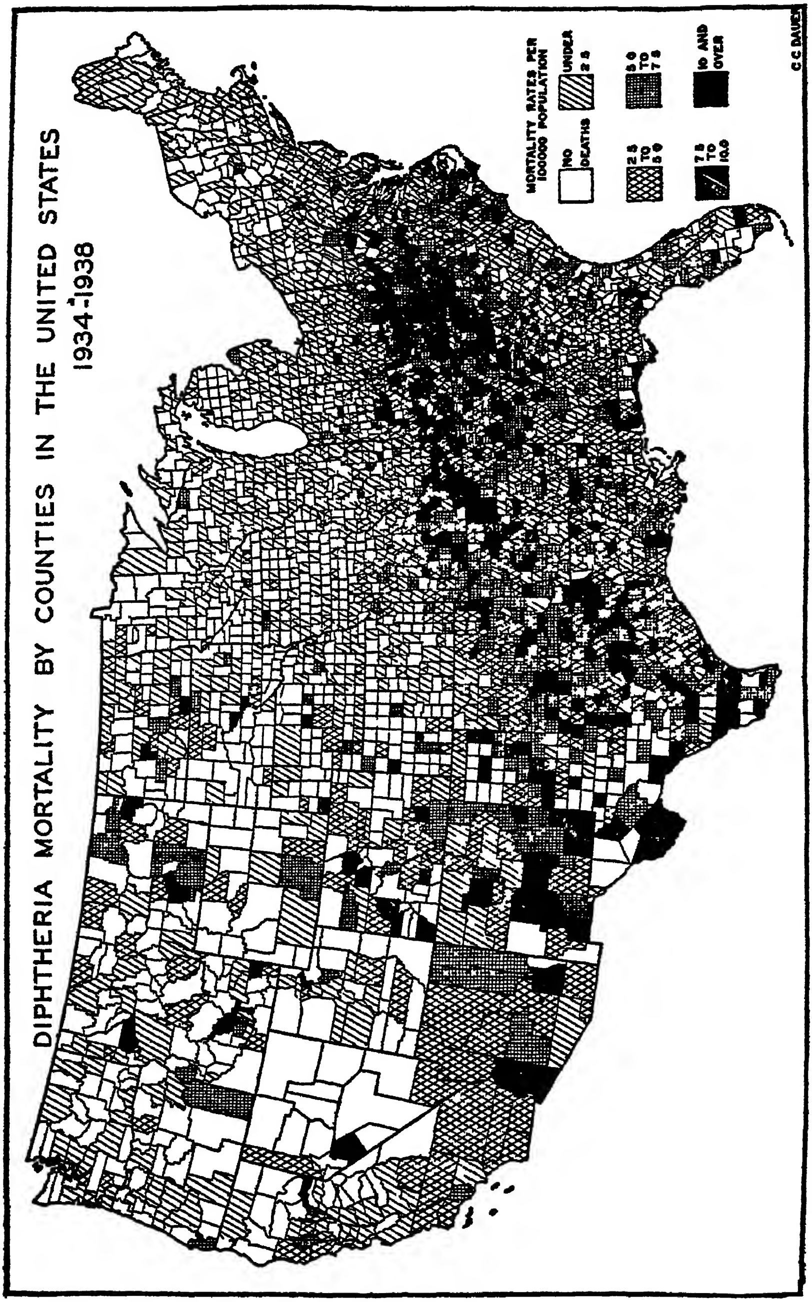

FIGURE 2.—Average annual mortality rates from diphtheria per 100,000 population, by counties, in the United States, 1934–1938

was due to artificial immunization and what part may have been due to the operation of other factors. However, by means of artificial immunization and provision for prompt and adequate serum therapy of cases, the health administrator can reduce diphtheria mortality in many cases to even lower levels.

In the preparation of this report it was necessary to obtain certain data from the bureaus of vital statistics in a large number of States. The author wishes to express his appreciation to the various State departments of health concerned for their effective cooperation.

THE INCIDENCE OF CANCER IN COOK COUNTY, ILLINOIS, 1937[1]

By Harold F. Dorn, *Statistician, United States Public Health Service*

The first paper in this series (*1*) discussed the general purpose of the study of the incidence of cancer in representative communities throughout the United States, the difference between morbidity and mortality records, and the precise procedure followed in the collection of the data. Reference should be made to that paper for details. It is sufficient to state that records were solicited only from physicians, hospitals, and clinics of all patients seen, treated, or observed for any malignant growth during the calendar year 1937. Enough identifying information was obtained to distinguish nonresident patients as well as patients treated by more than one respondent. It should be remembered that this report refers only to persons actually receiving medical attention for cancer and does not include those having undiagnosed growths nor persons with known cancer who, for some reason, did not receive medical care during the study year.

The number of persons reported under medical care for cancer in Cook County during 1937 was 14,160. Of these, 2,490 were nonresidents, while 11,670 were residents of the county. During the same period of time, 5,367 deaths among residents of the study area attributed to cancer were reported to the State health department. About 60 percent of these, 3,136 in number, were included in the reports returned by the physicians, hospitals, and clinics cooperating in the survey. This does not necessarily mean that only 60 percent of the living cases of cancer were reported. Investigation revealed that a large proportion of the unreported deaths were certified by the health officer or coroner after death; in other instances the death certificates were signed by a physician who had subsequently died or

[1] From the Division of Public Health Methods, National Institute of Health

This is the second in a series of papers on the incidence of cancer throughout the United States The data were collected under the supervision of Arthur J McDowell and Bernard D. Koteen. Miss Bess A. Cheney was in immediate charge of the tabulation of the records which was done as a project of the Work Projects Administration.

moved away. Whenever the physician who had signed the death certificate could be located he was requested to supply information concerning the case, but usually he would report that the case had been attended only at death, so that very little information was available. Undoubtedly, a small proportion of living cases of cancer were not reported since some physicians had to depend upon memory instead of written records. Fortunately these physicians were in general practice as a rule and undoubtedly saw only a limited number of cases of cancer or even none at all. However, the number of known cases of cancer among residents of the county is probably somewhat larger than that actually reported.

Although names of 7,728 physicians in the county were obtained from various sources, only 5,903 doctors were located; the remainder had died, moved away, retired, or were no longer in practice. Sixty-four percent, 3,757, of the physicians stated that they either did not treat cancer or had had no cases during the study year. Of those reporting cases, 65 percent reported 3 cases or less, indicating that the average practitioner treats only a very small number of cases during a year's time. Reports were obtained from all but 150 of the 5,903 physicians located.

Table 1 shows the number of cases reported by varying numbers of physicians and hospitals. About 30 percent of the cases were reported only by a physician and supposedly did not receive any treatment from a hospital during 1937. Approximately twice as many patients obtained medical care from hospitals or clinics only.

TABLE 1.—*Number and percentage of cases of cancer reported by specified number of physicians or hospitals, Cook County, Ill., 1937* [1]

Number of physicians or hospitals	Number of cases	Percentage
1 physician only	4,049	28.59
2 physicians only	147	1.04
3 physicians only	6	.04
Total	4,202	29.7
1 hospital only	8,038	56.8
2 hospitals only	309	2.2
3 hospitals only	18	.1
Total	8,365	59.1
1 physician, 1 hospital	1,279	9.0
1 physician, 2 or more hospitals	142	1.0
2 or more physicians, 1 hospital	144	1.0
2 or more physicians, 2 or more hospitals	28	.2
Total physicians and hospitals	1,593	11.2
Total cases	14,160	100.0

[1] Unless specifically stated otherwise, the number of cases used is the total number of reported cases including both residents and nonresidents and excluding deaths not reported as a case.

Since the value of a study of this nature depends not only upon the completeness with which the number of cases is reported, but also

upon the accuracy with which the diagnosis is made, the method of confirmation of diagnosis was requested for each case. Table 2 shows that about 70 percent of the diagnoses were confirmed by a microscopic examination of tissue which may have been obtained through biopsy, operation, or post mortem. The data reveal that a larger proportion of microscopically verified diagnoses occur among patients reported by hospitals than among those whose records were obtained only from a physician.

TABLE 2.—*Number and percentage of cases of cancer with a microscopically confirmed diagnosis, and whether or not reported by a hospital, Cook County, Ill., 1937*

Agency	Total number of cases	Cases with microscopic diagnosis	Percent
Hospital	9,959	7,326	73.6
Physician only	4,201	2,537	60.4
Total	14,160	9,863	69.7

For living cases, the accessibility of the tissue or organ affected is an important factor in determining whether or not the diagnosis is confirmed by a microscopic examination. However, certain forms of cancer such as cancer of the skin are frequently diagnosed by clinical evidence only. Less than one-half of the diagnoses of cancer of the esophagus, stomach and duodenum, liver and biliary passages, lung and pleura, and brain were confirmed microscopically. The corresponding percentages for breast, buccal cavity, and genito-urinary system were 85, 77, and 77, respectively. Malignant tumors of the brain, which frequently are referred to a brain specialist, were the only type with a higher percentage of microscopically confirmed diagnoses reported by physicians than by hospitals (table 3).

There are several ways in which the incidence of cancer may be expressed. One is analogous to a death rate; that is, the number of cases of cancer per 100,000 population. Because of the length of time since the last general census of population, it is difficult to obtain accurate estimates of population. For this reason, another measure of the incidence is used here, namely, the ratio of the number of cases to the number of reported deaths. If a reasonably accurate estimate of the death rate is available, the case rate of illness can be estimated by multiplying the death rate by the ratio of cases to deaths.

The number of cases alive at any time during the year per recorded death from cancer was 2.6 (table 4 and fig. 1). The ratio was higher for females than for males and higher for the white than for the colored population. Less than twice as many cases as deaths were reported for colored males, a fact which indicates that treatment is not generally received until the disease is too advanced for successful therapy. The death rate from cancer in Cook County around the date of the last

census was about 120 per 100,000, indicating that the case rate of illness was in the neighborhood of 325 to 350 per 100,000 in 1937.

TABLE 3.—*Percentage of cases of cancer with a microscopically confirmed diagnosis, by primary site, and whether or not reported by a hospital, Cook County, Ill., 1937*

Primary site	Percentage of cases with microscopically confirmed diagnosis for— All cases	Cases reported by hospitals	Cases reported only by a physician
Buccal cavity, pharynx	77.2	85.8	58.5
Lip	70.1	83.7	40.8
Tongue	79.3	86.3	65.8
Others	82.6	87.4	71.3
Digestive tract	57.0	61.7	43.9
Esophagus	49.6	52.9	37.3
Stomach, duodenum	43.1	49.3	25.7
Intestines	62.6	65.4	55.0
Rectum, anus	75.9	80.4	62.4
Liver, biliary passage	48.1	54.4	37.4
Pancreas	50.5	52.4	43.7
Mesentery, peritoneum	87.8	91.7	76.9
Respiratory system	66.1	69.0	55.4
Larynx	86.5	89.2	77.2
Lungs, pleura	49.3	53.6	31.7
Others	90.0	88.7	94.4
Genito-urinary system	76.9	89.2	70.4
Uterus	79.5	81.3	74.8
Kidneys	72.8	76.5	59.5
Prostate	62.9	68.9	45.2
Bladder	75.3	76.0	72.6
Others	85.5	87.5	80.3
Breast	84.9	87.0	81.3
Skin	55.9	64.0	45.9
Brain	47.5	42.7	70.8
Bones (except jaw)	71.1	73.0	66.2
Others	74.5	80.5	58.6
Total	69.7	73.6	60.4

TABLE 4.—*Number of reported cases, number of recorded deaths, and the ratio of cases to deaths from cancer, by sex and color, Cook County, Ill., 1937* [1]

	Total [2]			White			Colored		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
Cases [3]	13,901	6,033	7,868	12,842	5,713	7,129	671	203	468
Deaths	5,367	2,642	2,725	5,054	2,518	2,536	295	114	181
Cases per death [4]	2.6	2.3	2.9	2.5	2.3	2.8	2.3	1.8	2.6

[1] Resident cases and deaths only.
[2] Includes cases and deaths of unknown color.
[3] Includes deaths not reported as a case.
[4] The higher ratio for the total population than for either the white or colored populations arises from the inclusion of cases of unknown color in the total population.

Caution must be used in interpreting the ratio of cases to deaths as a measure of the prevalence of cancer. Although the number of deaths attributed to cancer can be fairly definitely determined, it is very difficult to obtain comparable information for the cases. How shall

a case of cancer be defined? Obviously the case must be diagnosed before it can be counted, so that the total number of diagnosed cases will almost always be smaller than the actual number of cases in the population. Shall only cases receiving some form of treatment be counted? If this definition were adopted, all cases under observation would be excluded so that the number of reported cases would be appreciably less than the actual number of cases in the population. But if cases under observation are to be reported, the total number of cases will be affected by the thoroughness with which cases are followed after treatment.

In this study a report was requested for each case seen, observed, or treated during the study year. Consequently the ratio of cases to deaths will be affected by variations in the completeness with which cases not under treatment are reported. In Cook County, 91.6 per-

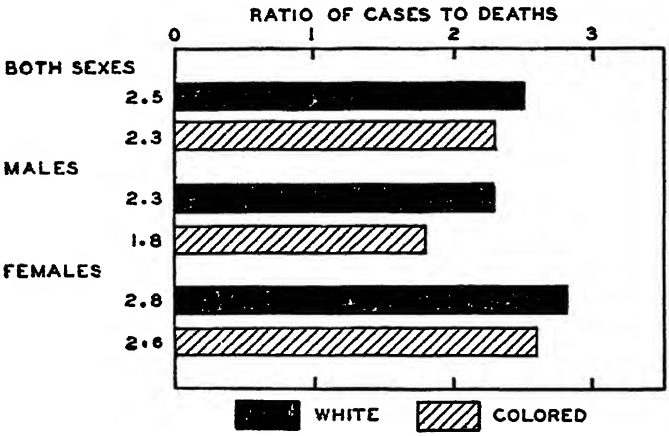

FIGURE 1.—Number of cases reported alive at any time during the year per recorded death from cancer during the year, by sex and color, Cook County, Ill., 1937.

cent of the reported cases received some treatment during the study year, while in Atlanta, Ga., only 75.5 percent of the reported cases were receiving treatment. This difference, in itself, increases the ratios of cases to deaths in Atlanta relative to that in Cook County.

Preliminary results for Detroit and Pittsburgh indicate corresponding percentages of 77.1 and 81.8. The reason for the lower percentage under observation in Chicago is unknown. Conceivably it may result from a failure to follow cases after treatment is stopped or from the fact that persons with cancer do not seek treatment until the disease is so far advanced that death occurs during the course of treatment.

Although cancer is primarily a disease of late adult life, table 5 shows that it occurs at all ages. About 60 percent of the females and 50 percent of the males reported as receiving medical treatment for cancer were in the main productive years of life, 30 to 60 years of age.

TABLE 5.—*Number and percentage distribution by age and sex of cases of cancer, Cook County, Ill., 1937*

Age	Percentage			Number of cases		
	Total	Male	Female	Total [1]	Male	Female
Under 10	0.4	0.5	0.4	63	31	32
10-19	.6	.7	.4	79	48	31
20-29	1.9	1.5	2.2	262	99	163
30-39	7.5	4.8	10.0	1,064	324	740
40-49	22.3	20.7	23.8	3,161	1,406	1,754
50-59	25.2	24.5	25.8	3,569	1,665	1,902
60-69	24.6	26.9	22.4	3,477	1,825	1,649
70-79	12.5	15.0	10.3	1,774	1,017	755
80 and over	2.2	2.7	1.8	318	185	133
Unknown	2.8	2.7	2.8	393	183	206
Total	100.0	100.0	100.0	14,160	6,783	7,365

[1] Includes cases of unknown sex.

The stomach was the most frequent primary site of malignant growth among males, although the skin was nearly as common (table 6). No other single site occurred very frequently except the prostate, reported for 8.5 percent of the cases, and the rectum and anus, reported for 8.4

TABLE 6.—*Percentage distribution of cases of cancer by primary site, sex, and color, Cook County, Ill., 1937*

Primary site	Total		White		Colored	
	Male	Female	Male	Female	Male	Female
Buccal cavity, pharynx	13.3	1.9	13.4	1.9	10.6	2.8
Lip	5.5	.3	5.7	.3	.5	.0
Tongue	2.8	.4	2.7	.4	5.1	.8
Mouth	.8	.1	.8	.1	.0	.2
Jaw	1.1	.4	1.1	.4	1.8	.0
Pharynx	.6	.1	.6	.1	.0	.0
Others	2.5	.6	2.5	.6	3.2	1.8
Digestive tract	35.0	20.3	35.2	21.3	30.8	11.0
Esophagus	3.1	.4	3.0	.4	5.1	.0
Stomach, duodenum	13.3	5.8	13.4	6.0	17.1	3.8
Intestines	6.8	6.2	6.9	6.5	6.5	3.1
Rectum, anus	8.4	4.6	8.5	4.8	6.9	3.1
Liver, biliary passage	1.5	2.2	1.6	2.4	1.4	1.0
Pancreas	1.5	.8	1.4	.9	2.3	.0
Mesentery, peritoneum	.4	.3	.4	.3	.5	.0
Respiratory system	9.5	1.4	9.6	1.4	6.5	1.8
Larynx	3.5	.2	3.5	.2	2.7	.3
Lungs, pleura	5.0	1.0	5.1	1.0	1.9	1.3
Others	1.0	.2	1.0	.2	1.9	.2
Genito-urinary system	19.3	34.4	18.9	32.7	26.9	57.4
Uterus	----------	26.4	----------	24.4	----------	51.5
Kidneys	2.0	.8	1.9	.8	1.4	.5
Bladder	6.4	1.9	6.5	1.9	3.7	2.1
Prostate	8.5	----------	8.3	----------	14.8	----------
Others	2.4	5.3	2.2	5.6	7.0	3.3
Breast	.2	29.2	.2	29.3	.0	21.9
Skin	12.4	6.5	12.5	6.9	3.7	1.3
Brain	1.4	.6	1.4	.7	1.4	.3
Bones (except jaw)	2.3	1.1	2.3	1.1	3.2	.5
Others	6.6	4.6	6.5	4.7	7.9	3.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

percent. As a group, the digestive tract included more than one-third of the sites reported, and the genito-urinary system included another one-fifth, so that the two combined accounted for more than one-half of the total number of cases (fig. 2).

The distribution of cases by primary site was strikingly different for females, 56 percent of whom had cancer of the breast or uterus. Due to the predominance of these two sites, no other part of the body was reported with marked frequency.

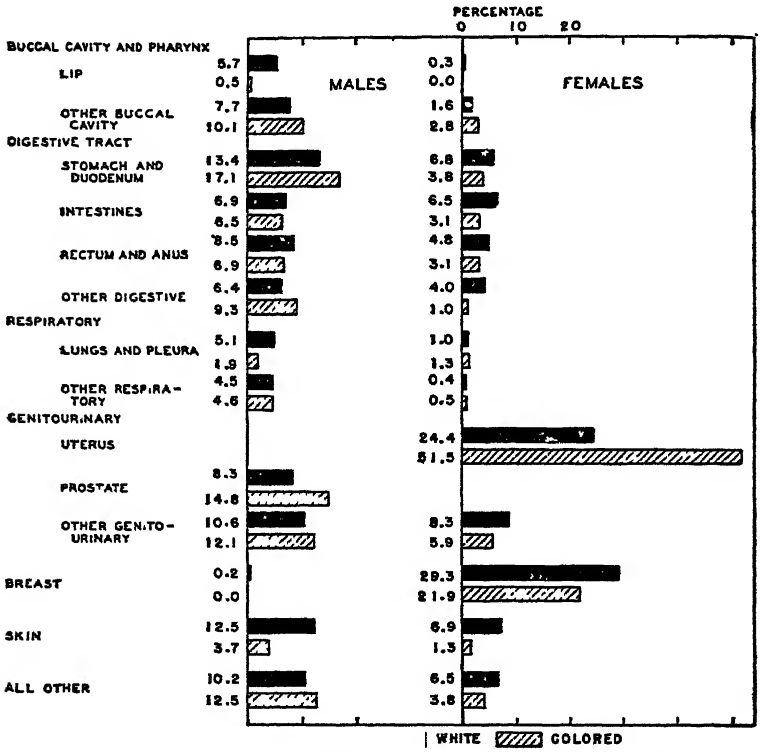

FIGURE 2.—Percentage distribution of cases of cancer by primary site, sex, and color, Cook County, Ill., 1937.

This concentration of the type of malignant neoplasm reported was more noticeable among colored than among white females. Among white women, 54 percent of the cases had cancer of the uterus or breast, but 73 percent of the cases among colored women were reported to have cancer of these two sites. Cancer of the genito-urinary system as a whole occurred more commonly among Negroes than among whites for both males and females. On the other hand, skin cancer was only about one-fourth as frequent among the colored cases. In this connection it should be remembered that the frequency of occurrence of cancer of different sites depends to a certain extent upon

the age distribution of the two groups, since not all lesions develop at the same age.

Table 6a presents the percentage distribution by sex and primary site of the cases first seen during the study year, 1937. The principal difference between these percentages and those in table 6 is the greater frequency of sites in the digestive tract among the cases first seen during 1937. This is in agreement with expectation, since the forms of cancer which are less likely to be cured should be found relatively more frequently among new cases.

TABLE 6a.—*Percentage distribution of cases of cancer first seen in 1937 by primary site and sex, Cook County, Ill.*

Primary site	Male	Female	Primary site	Male	Female
Buccal cavity, pharynx	11.2	1.7	Respiratory system	9.7	1.8
Lip	4.4	.3	Larynx	3.3	.2
Tongue	2.4	.3	Lungs, pleura	5.5	1.4
Mouth	.7	.2	Others	.9	.2
Jaw	1.1	.4			
Pharynx	.6	------	Genito-urinary system	19.3	33.2
Others	2.0	.5			
			Uterus	--------	25.0
Digestive tract	39.1	24.7	Kidneys	2.2	.8
			Bladder	6.1	1.9
Esophagus	3.5	.4	Prostate	8.9	--------
Stomach, duodenum	15.7	7.5	Others	2.1	5.5
Intestines	7.5	7.4			
Rectum, anus	8.3	5.0	Breast	.2	25.8
Liver, biliary passage	1.9	3.0	Skin	10.8	6.1
Pancreas	1.7	1.0	Brain	1.6	.8
Mesentery, peritoneum	.5	.4	Bones (except jaw)	2.1	1.0
			Others	6.0	4.9
			Total	100.0	100.0

Since the various forms of therapy now in use are not uniformly effective against all types of lesions, and since some tumors are more malignant than others, the frequency of occurrence of different sites varies considerably between living and dead cases (table 7). The principal sites which occur more frequently among the living cases are the buccal cavity and skin. Somewhat smaller differences exist for the uterus and breast. On the other hand, cancer of the digestive tract, especially of the stomach and intestines, and to a lesser extent cancer of the respiratory system, are relatively more frequent as causes of death (fig. 3).

Although it is not possible to determine accurately the age at which the different organs and tissues are most likely to develop cancer, the data in table 8 do reveal the ages when lesions have become sufficiently advanced to cause the patient to seek treatment. The age at which cancer begins to develop is, of course, somewhat younger than that shown in this table. It is evident that the location of the primary site of cancer varies considerably with the age of the patient. Two parts of the body, the brain and the skeletal system, are especially likely

to be attacked by cancer at an early age; 57 percent of the brain cases and 48 percent of the bone cases were less than 45 years of age, whereas the corresponding percentage for all cases was only 20.

TABLE 7.—*Percentage distribution by primary site and sex of reported cases and recorded deaths from cancer, Cook County, Ill., 1937*

Primary site	Total male		Total female	
	Cases	Deaths	Cases	Deaths
Buccal cavity, pharynx	12.6	6.4	1.5	0.9
Lip	5.5	.6	.3	.0
Tongue	2.8	1.8	.4	.1
Mouth	.8	.6	.1	.1
Jaw	1.1	.9	.4	.3
Pharynx	6	1.2	.1	.2
Others	1.8	1.3	.2	.2
Digestive tract	35.0	54.7	20.3	42.3
Esophagus	3.1	5.6	.4	1.3
Stomach, duodenum	13.3	22.7	5.8	13.4
Intestines	6.8	9.9	6.2	12.3
Rectum, anus	8.4	7.4	4.6	4.4
Liver, biliary passage	1.5	4.8	2.2	7.4
Pancreas	1.5	3.9	.8	2.9
Mesentery, peritoneum	.4	.4	.3	.6
Respiratory system	9.5	12.2	1.4	3.0
Larynx	3.5	2.5	.2	.0
Lungs, pleura	4.7	7.3	.9	2.6
Others	1.3	2.4	.3	.4
Genito-urinary system	19.3	17.8	34.3	29.7
Uterus	---	---	26.4	20.5
Kidneys	2.0	2.2	.8	1.1
Bladder	6.4	6.1	1.9	2.4
Prostate	8.5	8.4	---	---
Others	2.4	1.1	5.2	5.7
Breast	.2	.3	29.2	17.7
Skin	12.4	1.2	6.5	.9
Brain	1.4	.5	.6	.4
Bones (except jaw)	2.3	1.7	1.1	1.0
Others	7.3	5.2	5.1	4.1
Total	100.0	100.0	100.0	100.0

About one-half of the persons with cancer were from 45 to 64 years of age, inclusive. With the exception of lesions of the brain, bones, and prostate the proportion of cases in this age period did not vary greatly among the different organs or tissues involved. Malignant tumors of the respiratory system were the outstanding exception to this statement; nearly two-thirds (64 percent) of such cases were in the age group 45 to 64.

The greatest concentration of cases among the aged, here considered to be 65 or more years of age, is shown by malignant growths of the pancreas. Nearly two out of every three cancers of the pancreas occurred among persons in this age group as compared with an average of one in four for all forms of cancer combined. Other tissues or organs with a larger than average proportion of cases among elderly persons were the tongue, bladder, digestive system, and skin.

The data in table 8 were arranged to indicate the age periods when particular parts of the body were most likely to develop cancer. But, owing to the fact that some forms of cancer occur more frequently than others, these data do not show the relative importance of the various sites at each age. In figure 4 the relative frequency by age is shown for certain broad groups of sites.

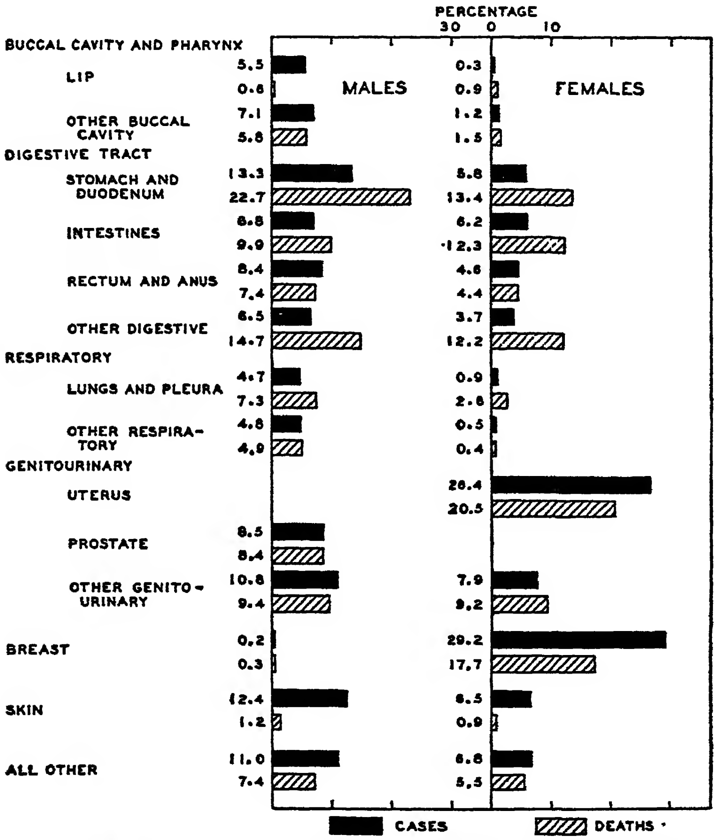

FIGURE 3.—Percentage distribution of reported cases of cancer and recorded deaths from cancer by primary site and sex, Cook County, Ill., 1937.

Among children and adolescents, the brain and bones are the most frequent sites of cancer, followed closely by the digestive tract, genito-urinary system, and skin. But throughout most of adult life until about age 75, the majority of sites affected by cancer are in the digestive tract, the genito-urinary system, and breast. The relative frequency of the latter two decreases somewhat after 75 years of age, when skin cancer again becomes comparatively more common.

TABLE 8.—*Percentage distribution of cases of cancer by age and primary site, Cook County, Ill., 1937*

Primary site	Under 25	25–34	35–44	45–54	55–64	65–74	75 and over	Un-known	Total
Buccal cavity, pharynx	1.1	2.3	13.7	23.6	25.7	21.2	8.8	3.6	100
Lip	------	1.3	18.2	28.1	24.1	18.0	6.3	4.0	100
Tongue	.4	.9	9.3	23.6	26.7	24.4	10.7	4.0	100
Others	2.6	4.0	11.9	19.4	26.6	22.4	10.1	3.0	100
Digestive tract	.6	2.3	10.1	22.6	28.8	24.2	9.3	2.1	100
Esophagus	------	1.3	6.3	19.8	36.7	24.1	10.5	1.3	100
Stomach, duodenum	.2	1.4	8.6	22.5	30.5	24.6	10.2	2.0	100
Intestines	1.0	3.1	11.3	23.2	25.6	24.9	9.5	1.4	100
Rectum, anus	.7	3.5	12.4	22.8	25.9	24.5	6.9	3.3	100
Liver, biliary passage	.7	.4	7.8	20.0	33.3	24.1	11.9	1.8	100
Others	1.9	3.4	10.6	26.1	30.4	18.4	7.3	1.9	100
Respiratory system	1.7	2.7	13.8	33.9	29.9	12.0	3.3	2.7	100
Lungs, pleura	1.9	3.1	12.3	33.2	32.7	11.8	3.1	1.9	100
Others	1.5	2.2	15.7	34.7	26.3	12.4	3.6	3.6	100
Genito-urinary system	.6	4.9	17.7	25.7	24.0	19.3	6.4	1.4	100
Uterus	.1	6.6	22.7	31.7	23.1	11.8	2.6	1.4	100
Bladder	.2	1.6	10.4	24.5	26.1	27.8	8.5	.9	100
Prostate	------	.5	1.2	7.3	25.6	43.0	20.8	1.6	100
Others	2.4	6.4	22.9	25.4	23.5	14.2	3.6	1.6	100
Breast	.6	4.6	20.1	30.0	24.4	14.1	3.6	2.6	100
Skin	1.9	2.2	10.9	20.4	25.1	20.2	10.9	8.4	100
Brain	21.3	9.2	26.3	22.7	17.7	2.1	------	.7	100
Bones (except jaw)	20.1	7.9	20.1	19.7	20.1	8.4	2.5	1.2	100
Others	5.0	6.9	17.9	23.3	21.2	16.3	5.7	3.7	100
Total	1.6	3.8	15.0	25.0	25.6	19.2	7.0	2.8	100

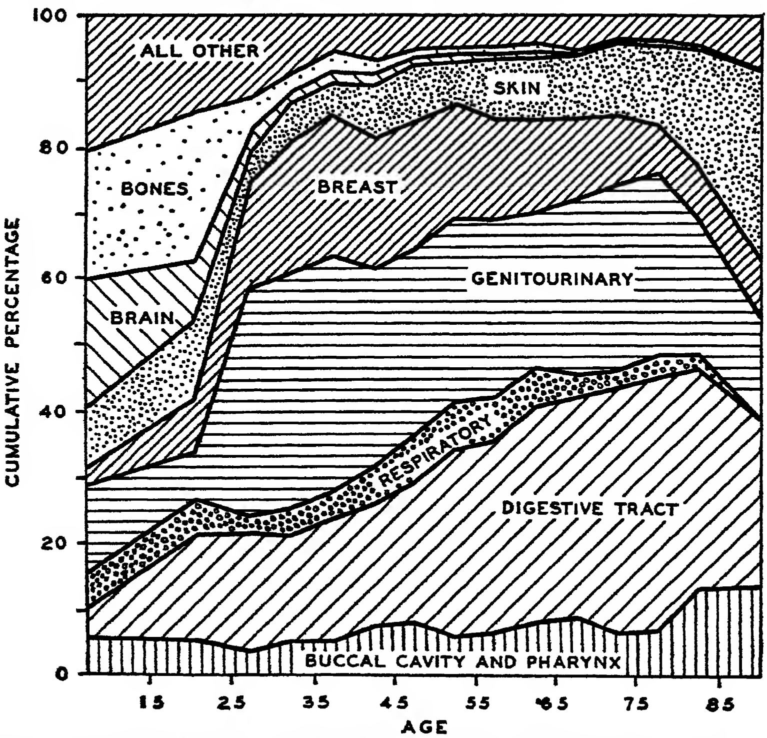

FIGURE 4.—Percentage distribution of cases of cancer by primary site and age, Cook County, Ill., 1937.

The statement is often made that if medical treatment is begun at a sufficiently early stage in the development of a malignant growth the cancer will either be "cured" or its development arrested so that the patient may frequently expect to live several additional years. It was hoped that this study would provide information concerning this point, but owing to the fact that current records are not uniformly available for cancer patients discharged as "cured," the reported data are incomplete and include, as a rule, only cases receiving treatment at some time during the calendar year. The number of reported cases classified by the number of months since the diagnosis [2] was made and by vital condition at the end of the study year is shown in table 9.

TABLE 9.—*Number and percentage of cases of cancer by the number of months since diagnosis, and vital condition, Cook County, Ill., 1937*

Number of months since diagnosis [2]	Percentage			Number		
	All cases	Cases dead at end of year	Cases alive at end of year	All cases [1]	Cases dead at end of year	Cases alive at end of year
Under 6	47.9	62.8	37.0	6,780	2,720	2,921
6-11	23.9	18.2	27.7	3,385	788	2,186
12-17	8.6	7.6	9.8	1,210	329	771
18-23	5.2	3.1	6.9	743	134	546
24-29	3.1	2.3	3.7	445	98	293
30-35	2.2	1.3	3.0	314	55	233
36-41	1.7	.9	2.4	246	38	188
42-47	1.3	.6	1.8	188	27	142
48-53	.9	.5	1.2	133	20	95
54-59	.8	.3	1.0	111	14	79
60 and over	4.0	2.0	5.5	562	88	429
Unknown	.4	.4	.0	43	18	10
Total	100.0	100.0	100.0	14,160	4,329	7,893

[1] Includes cases of unknown vital condition at end of year.
[2] Each interval includes 6 months' duration. The first interval, under 6, includes cases diagnosed from July through December 1937 and in addition all cases who died less than 6 months after diagnosis. A similar procedure was followed in classifying cases into the other duration groups.

Nearly one-half of the patients had been under medical care for cancer less than 6 months. Another one-fourth had been under medical care from 6 months to a year, so that, in all, about three-fourths of the cases were of less than 1 year's duration (table 10). When only the fatal cases are considered, it is found that 63 percent were diagnosed within 6 months prior to death and another 18 percent were diagnosed from 6 months to a year prior to death. Although the corresponding percentages for the surviving cases are high, they are considerably less than those for the fatal cases. Twenty-five percent of the surviving cases had lived at least 18 months since diagnosis, as compared with only 10 percent for the fatal cases. It

[2] This is not necessarily the number of months since the first diagnosis of cancer was made. It is the number of months since diagnosis by a physician who treated the case during the study year. In most instances the two are probably the same.

should be remembered that, whereas the fatal cases include all cases dying during the year, the cases alive at the end of the year do not include all the surviving cases. It is believed that almost all of the "cured" cases of cancer as well as an appreciable proportion of cases under observation only were not reported, since such cases were usually not on the active list of patients under treatment. If such cases were included, they would undoubtedly fall in the longer duration classes of table 10, thus increasing the contrast between the fatal and the surviving cases.

TABLE 10.—*Percentage of cases of cancer which had been diagnosed for less than certain specified number of months classified by vital condition at the end of the year, Cook County, Ill., 1937*

Duration in months since diagnosis	All cases [1]	Cases alive at end of year	Cases dying before end of year
Less than 6 months	48	37	63
Less than 12 months	72	65	81
Less than 18 months	80	75	89
Less than 24 months	86	81	92
Less than 30 months	89	85	94
Less than 36 months	91	88	95
Less than 42 months	93	91	96
Less than 48 months	94	92	97
Less than 54 months	95	94	97
Less than 60 months	96	95	98

[1] Includes cases of unknown vital condition.

The data in tables 9 and 10 would seem to indicate clearly that a considerable proportion of persons with cancer do not seek medical treatment until the disease is in its advanced stages. The only other explanation would be that the fatal cases are principally those with primary sites which cannot be successfully treated as a rule, while the surviving cases indicate those most successfully treated, such as cancer of the skin for example.

As pointed out previously the data in table 7 show that the primary sites which are the most difficult to treat successfully do occur frequently among the dead cases. However, the cases classed as alive in that table include all cases alive at any time during the year and hence include all cases who died before the end of the year. Moreover, the primary site for the dead cases was taken from the death certificate and not from the case report.

In table 11, the percentage distribution by primary site is shown for cases alive at the end of the year and cases that died sometime during the year. The higher proportion among the cases that died of primary sites located in the digestive tract and respiratory system as contrasted with the higher proportion of cancer of the buccal cavity, breast, and skin among the surviving cases is clearly evident. One-half of the fatal cases died from cancer of the digestive or respiratory systems while only one-fourth of the surviving cases had primary

sites in the same organs. It is unquestionably true that the fatal cases included a larger proportion of types of malignant neoplasms which are most difficult to treat successfully.

TABLE 11.—*Percentage distribution by primary site of cases alive at the end of the year and cases dying before the end of the year, Cook County, Ill., 1937*

Primary site	Cases alive at end of year	Cases dying before end of year	Primary site	Cases alive at end of year	Cases dying before end of year
Buccal cavity, pharynx	8.6	5.1	Respiratory system—Con.		
Lip	3.5	.8	Lungs, pleura	1.4	6.1
Tongue	1.7	1.7	Others	.5	.6
Mouth	.6	.2	Genito-urinary system	27.4	24.7
Jaw	.9	.6	Uterus	15.3	9.2
Pharynx	.2	.6	Kidneys	1.1	1.9
Others	1.7	1.2	Bladder	3.8	4.1
Digestive tract	20.1	42.9	Prostate	3.3	5.2
Esophagus	1.0	3.4	Others	3.9	4.0
Stomach, duodenum	5.9	16.0	Breast	18.9	8.6
Intestines	4.9	10.3	Skin	13.1	2.1
Rectum, anus	6.5	6.5	Brain	.9	1.1
Liver, biliary passage	1.0	4.0	Bones (except jaw)	1.8	1.6
Pancreas	.6	2.2	Others	5.4	5.4
Mesentery, peritoneum	.2	.5	Total	100.0	100.0
Respiratory system	3.9	8.5			
Larynx	1.9	1.8			

Nevertheless, this fact alone does not entirely account for the difference in duration since diagnosis of the living and dead cases shown in table 9. This conclusion seems apparent from the data in table 12, where the duration since diagnosis of surviving and of fatal cases of cancer is presented for five important broad groups of sites. Even when the comparison is restricted to the same sites, it is evident that the surviving cases had been under medical care for a greater length of time than the fatal cases. Persons with cancer of the breast were the only exceptions to this; for these cases there was almost no difference in the distribution by duration since diagnosis of the living and the dead cases.

TABLE 12.—*Percentage of cases of cancer which had been diagnosed for less than certain specified number of months, classified by primary site and vital condition at the end of the year, Cook County, Ill., 1937*

Duration in months since diagnosis	Buccal cavity		Digestive tract		Respiratory system		Genito-urinary system		Breast	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Less than 6 months	33	43	49	73	47	73	34	57	31	41
Less than 12 months	59	73	78	88	73	89	62	78	57	57
Less than 18 months	71	83	85	94	80	96	72	87	67	67
Less than 24 months	79	86	91	96	85	97	80	90	74	75
Less than 30 months	82	90	93	97	90	98	84	94	79	80
Less than 36 months	86	94	95	98	93	99	88	95	82	83
Less than 42 months	89	96	96	99	95	99	90	96	86	85
Less than 48 months	92	97	96	99	96	99	92	97	89	88
Less than 54 months	92	98	97	99	96	99	94	97	91	89
Less than 60 months	93	99	97	99	96	99	95	98	92	91

The cases with the shortest duration since diagnosis were those with the primary site in the digestive tract or respiratory system. About three-fourths of such cases who were still alive at the end of the year were diagnosed sometime during the year, but nearly 90 percent of those who died had been diagnosed within the past 12 months. Moreover, 73 percent of those who died with cancer of the digestive tract or respiratory system had been diagnosed less than 6 months before. The conclusion seems inescapable that a large proportion of persons with cancer of these parts of the body either do not seek medical care or, if medical care is sought, are not correctly diagnosed until the disease is too far advanced for successful treatment.

The same comment applies almost equally well to persons with cancer of the buccal cavity or genito-urinary system. Only 57 percent of fatal cases of buccal cancer and 43 percent of fatal cases of genito-urinary cancer had been under treatment for more than 6 months at the time of death. However, of the surviving cases two-thirds had been diagnosed for at least 6 months.

In this connection it would be interesting to estimate the average number of years a person with cancer could expect to live, but the data at hand do not lend themselves to such computations because they contain a disproportionate number of cases with a short duration. As previously pointed out, it is believed that "cured" cases were incompletely reported because they were not being treated during the study year. This fact should be borne in mind when interpreting the data for living cases in tables 9 to 12.

A measure of the severity of a disease frequently used in studies of communicable diseases is the case fatality rate, or the percent of the cases which fail to survive. Owing to the fact that cancer is a chronic rather than an acute disease, it is not possible to compute a rate of this nature which will have the same simple meaning. It is possible, however, to use an analogous percentage, namely, the proportion of cases diagnosed during the year who are dead by the end of the year (table 13).

TABLE 13.—*Number and percentage of resident cases of cancer first seen in 1937, by sex, color, and vital condition at the end of 1937*

Vital condition	Percentage				Number			
	White		Colored		White		Colored	
	Male	Female	Male	Female	Male	Female	Male	Female
Alive	47.4	57.5	29.3	49.0	1,656	2,308	39	121
Unknown	14.4	16.1	20.3	21.1	503	645	27	52
Dead	38.2	26.4	50.4	29.9	1,336	1,063	67	74
Total	100.0	100.0	100.0	100.0	3,405	4,016	133	247

One-third of the resident cases first seen in 1937 died during the same year. In other words, these cases lived only from 3 to 4 months after diagnosis, indicating that medical care was not sought until the disease was well advanced. Large differences were reported for the two sexes and for white and colored persons. A larger proportion of males than of females died in the same year that diagnosis was made; the same was true for the colored when compared with the white

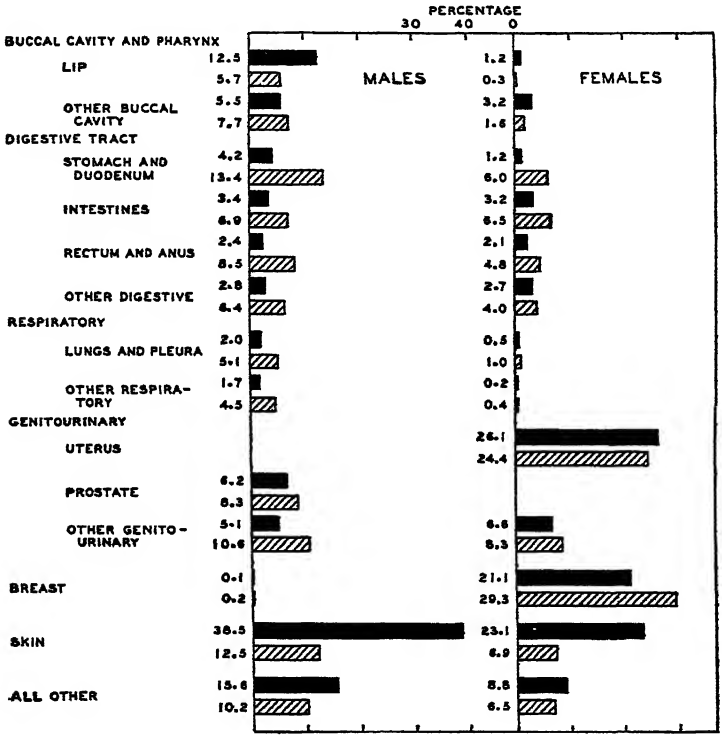

FIGURE 5.—Percentage of reported cases of cancer by primary site and sex for white persons, Atlanta, Ga. and Chicago, Ill., 1937

cases, especially for males. One-half of the number of colored males diagnosed during 1937 died during that year.

One of the purposes of this series of surveys is to discover what difference, if any, exists in the frequency of various primary sites reported in different parts of the country. Since the data for a southern city, Atlanta, Ga., have already been published it is possible to compare at this time the distribution of cases classed by primary site in a northern city, Chicago (Cook County), and a southern city, Atlanta.

There are distinct differences in the distribution of cases by primary site in Chicago and Atlanta. The most apparent of these is the

relative frequency of malignant lesions of the skin and digestive tract. In Atlanta, 38.5 percent of all cases among white males were reported to be cancer of the skin while only 12.5 percent of all cases in Chicago were so classified. On the other hand, cancer of the digestive tract, which accounted for 12.8 percent of all cases in Atlanta, occurred in 35.2 percent of the cases in Chicago. Thus the relative importance of cancer of the skin and cancer of the digestive tract was almost exactly reversed in the two cities (fig. 5).

The difference in the relative frequency of various sites followed the same general pattern for white females as for white males, especially with reference to cancer of the skin and cancer of the digestive tract. However, only a slight difference was reported in the relative importance of cancer of the uterus and breast, the two most common sites in women.

Some caution should be used in interpreting the data in table 14, since they represent a percentage distribution of the cases and not case rates. The figures in this table could be converted into case rates of illness by multiplying by the rate for all forms of cancer. Such rates have not been computed because of the uncertainty attached to estimates of population. Approximate estimates indicate that the

TABLE 14.—*Percentage of reported cases of cancer by primary site and sex for the white population, Atlanta, Ga., and Chicago, Ill., 1937*

Primary site	White male		White female	
	Atlanta	Chicago	Atlanta	Chicago
Buccal cavity, pharynx	18.0	13.4	4.4	1.9
Lip	12.5	5.7	1.2	.3
Tongue	1.5	2.7	.5	.4
Mouth	1.1	.8	.4	.1
Jaw	1.0	1.1	1.0	.4
Pharynx	.3	.6	.1	.1
Others	1.6	2.5	1.2	.6
Digestive tract	12.8	35.2	9.2	21.3
Esophagus	.6	3.0	.7	.4
Stomach, duodenum	4.2	13.4	1.2	6.0
Intestines	3.4	6.9	3.2	6.5
Rectum, anus	2.4	8.5	2.1	4.8
Liver, biliary passage	.7	1.6	1.3	2.4
Pancreas	1.1	1.4	.6	.9
Mesentery, peritoneum	.4	.4	.1	.3
Respiratory system	3.7	9.6	.7	1.4
Larynx	1.2	3.5	.2	.2
Lungs, pleura	2.0	5.1	.5	1.0
Others	.5	1.0	.0	.2
Genito-urinary system	11.3	18.9	32.7	32.7
Uterus			26.1	24.4
Kidneys	.7	1.9	.9	.8
Bladder	2.5	6.5	1.6	1.9
Prostate	6.2	8.3		
Others	1.9	2.2	4.1	5.6
Breast	.1	.2	21.1	29.3
Skin	38.5	12.5	23.1	6.9
Brain	3.2	1.4	1.8	.7
Bones (except jaw)	1.4	2.3	1.1	1.1
Others	11.0	6.5	5.9	4.7
Total	100.0	100.0	100.0	100.0

case rates of illness do not differ greatly in the two areas, although that for Atlanta is probably slightly greater. If this is true the data in table 14 present a fair representation of the relative importance of the various sites in Atlanta and Chicago.

SUMMARY

The number of cases of cancer under medical care in Cook County, Ill., during 1937 was 14,160, of which 2,490 were nonresident and 11,670 were residents of the county. During the year 5,480 deaths attributed to cancer among residents of the county were registered with the State Health Department.

The ratio of cases to deaths was 2.6 for both sexes, 2.3 for males, and 2.9 for females. Less than twice as many cases as deaths were reported for colored males, a fact which indicates that treatment is not generally received until the disease is too far advanced for successful therapy.

Although cancer is primarily a disease of late adult life, cases occur at all ages. About 60 percent of the females and 50 percent of the males with cancer were in the main productive years of life, 30 to 60 years of age.

The stomach was the most frequent primary site among males. As a group, the digestive tract included more than one-third of the reported sites, while the genito-urinary system included another one-fifth; the two combined accounted for more than one-half of the total number of cases.

There was a marked sex difference in the distribution of primary sites. Fifty-six percent of the females had cancer of the breast or uterus.

Cancer of the genito-urinary system was proportionately more common among the colored cases while skin cancer was more common among the whites.

The location of the primary site of cancer varies considerably with the age of the patient. The brain and skeletal system are especially likely to be attacked by cancer at an early age; 57 percent of the brain cases and 48 percent of the bone cases were less than 45 years of age, whereas the corresponding percentage for all cases was only 20. On the other hand, nearly two out of every three cases of cancer of the pancreas occurred among persons 65 or more years of age. Other tissues or organs frequently attacked during this age period were the tongue, bladder, skin, and digestive system.

Nearly one-half of the patients had been under medical care less than 6 months since diagnosis and about three-fourths of the cases were of less than 1 year's duration. More than 80 percent of the cases who died during the year had been receiving treatment for

less than 1 year; 65 percent of the surviving cases had been under treatment for less than a year since diagnosis.

The duration since diagnosis varied widely for cases with different primary sites. About 90 percent of the cases that died during the year with cancer of the digestive tract or respiratory system had been diagnosed less than 12 months before death. The corresponding percentages for cases with primary sites in the buccal cavity, genito-urinary system, and breast were 73, 78, and 57, respectively.

Slightly more than one-third of all cases under treatment died before the end of the year.

Several distinct differences appear when the distribution of primary sites in Cook County is compared with similar data for Atlanta, Ga. The most apparent of these is the relative frequency of malignant lesions of the skin and digestive tract. In Atlanta, 38.5 percent of all cases among white males had cancer of the skin while only 12.5 percent of all cases in Cook County were so classified. On the other hand, cancer of the digestive tract, which accounted for 12.8 percent of all cases in Atlanta, occurred in 35.2 percent of the cases in Cook County.

REFERENCE

(*1*) Mountin, Joseph W., Dorn, Harold F., and Boone, Bert R.: The incidence of cancer in Atlanta, Ga., and surrounding counties. Pub. Health Rep., 54: 1255–1273 (1939).

Appendix

TABLE 1.—*Number of cases of cancer reported, and number with a microscopically confirmed diagnosis, by primary site, and whether or not reported by a hospital, Cook County, Ill., 1937*

Primary site	Reported by a hospital		Reported only by physicians		All reports	
	Total	Number with microscopic diagnosis	Total	Number with microscopic diagnosis	Total	Number with microscopic diagnosis
Buccal cavity, pharynx	717	615	331	193	1,048	808
Lip	270	226	125	51	395	277
Tongue	146	126	77	50	223	176
Mouth	42	36	23	18	65	54
Jaw	71	61	36	29	107	90
Pharynx	32	30	11	4	43	34
Others	156	136	59	41	215	177
Digestive tract	2,849	1,759	1,022	449	3,871	2,208
Esophagus	187	99	51	19	238	118
Stomach, duodenum	979	483	350	90	1,329	573
Intestines	668	437	251	138	919	575
Rectum, anus	682	548	226	141	908	689
Liver, biliary passage	171	93	99	37	270	130
Pancreas	126	66	32	14	158	80
Mesentery, peritoneum	36	33	13	10	49	43
Respiratory system	590	407	157	87	747	494
Larynx	194	173	57	44	251	217
Lungs, pleura	334	179	82	26	416	205
Others	62	55	18	17	80	72

TABLE 1.—*Number of cases of cancer reported, and number with a microscopically confirmed diagnosis, by primary site, and whether or not reported by a hospital, Cook County, Ill., 1937*—Continued

Primary site	Reported by a hospital		Reported only by physicians		All reports	
	Total	Number with microscopic diagnosis	Total	Number with microscopic diagnosis	Total	Number with microscopic diagnosis
Genito-urinary system	2,852	2,258	990	697	3,842	2,955
Uterus	1,410	1,146	532	398	1,942	1,544
Kidneys	149	114	42	25	191	139
Prostate	431	297	146	66	577	363
Bladder	462	351	113	82	575	433
Others	400	350	157	126	557	476
Breast	1,359	1,183	802	652	2,161	1,835
Skin	731	468	595	273	1,326	741
Brain	117	50	24	17	141	67
Bones (except jaw)	174	127	65	43	239	170
Others	570	459	215	126	785	585
Total	9,959	7,326	4,201	2,537	14,160	9,863

TABLE 2.—*Number of cases of cancer by primary site, sex, and color, Cook County, Ill., 1937*

Primary site	Total		White		Colored	
	Male	Female	Male	Female	Male	Female
Buccal cavity, pharynx	905	142	866	122	23	11
Lip	373	22	366	22	1	
Tongue	191	32	176	29	11	3
Mouth	54	10	52	9		1
Jaw	78	29	72	28	4	
Pharynx	41	2	41	2		
Others	168	47	159	37	7	7
Digestive tract	2,374	1,490	2,271	1,429	86	43
Esophagus	209	28	197	28	11	
Stomach, duodenum	903	424	862	405	37	15
Intestines	462	455	446	436	14	12
Rectum, anus	568	338	546	321	15	12
Liver, biliary passage	105	165	101	159	3	4
Pancreas	99	59	92	59	5	
Mesentery, peritoneum	28	21	27	21	1	
Respiratory system	642	105	621	95	14	7
Larynx	236	15	226	14	6	1
Lungs, pleura	339	77	333	69	4	5
Others	67	13	62	12	4	1
Genito-urinary system	1,309	2,533	1,217	2,190	58	225
Uterus		1,942		1,639		202
Kidneys	135	56	124	52	3	2
Prostate	577		533		32	
Bladder	437	138	416	127	8	8
Others	160	397	144	372	15	13
Breast	14	2,147	13	1,967		86
Skin	841	482	809	464	8	5
Brain	95	46	91	45	3	1
Bones (except jaw)	158	81	146	76	7	2
Others	445	339	416	313	17	12
Total	6,783	7,365	6,450	6,706	216	392

TABLE 3.—*Number of recorded deaths from cancer by primary site, sex, and color, Cook County, Ill., 1937*

Primary site	Total		White		Colored	
	Male	Female	Male	Female	Male	Female
Buccal cavity, pharynx	189	26	179	22	9	4
Lip	18	1	18	1		
Tongue	52	4	49	3	2	1
Mouth	17	2	16	1	1	1
Jaw	26	8	25	7	1	1
Pharynx	37	5	37	5		
Others	39	6	34	5	5	1
Digestive tract	1,615	1,177	1,540	1,119	71	55
Esophagus	164	35	154	35	10	
Stomach, duodenum	672	374	644	358	26	15
Intestines	292	343	278	330	13	13
Rectum, anus	219	123	211	110	8	13
Liver, biliary passage	143	207	138	197	5	8
Pancreas	114	80	105	75	8	5
Mesentery, peritoneum	11	15	10	14	1	1
Respiratory system	361	82	348	77	11	5
Larynx	75		74			
Lungs, pleura	216	72	207	67	9	5
Others	70	10	67	10	2	
Genito-urinary system	524	828	499	755	22	69
Uterus		572		507		61
Kidneys	64	30	63	29	1	1
Bladder	180	68	178	66	5	2
Prostate	249		234		15	
Others	31	158	29	153	1	5
Breast	8	492	7	455	1	36
Skin	36	26	34	26	2	
Brain	14	11	13	10	1	1
Bones (except jaw)	51	27	47	22	4	5
Others	154	115	146	110	8	5
Total	2,952	2,784	2,813	2,596	129	180

TABLE 4.—*Distribution of cases of cancer by age and primary site, Cook County, Ill., 1937*

Primary site	Under 25	25–34	35–44	45–54	55–64	65–74	75 and over	Unknown	Total
Buccal cavity, pharynx	12	24	144	247	269	222	92	38	1,048
Lip		5	72	111	95	71	25	16	395
Tongue	1	2	21	53	60	55	24	9	225
Mouth	2	2	8	16	14	13	7	2	64
Jaw	5	5	11	13	32	25	13	2	106
Pharynx		1	5	5	14	17	6	3	51
Others	4	9	27	49	54	41	17	6	207
Digestive tract	24	89	390	875	1,116	938	358	81	3,871
Esophagus		3	15	47	87	57	25	3	237
Stomach, duodenum	3	18	115	300	406	327	136	26	1,331
Intestines	9	28	104	213	235	229	87	13	918
Rectum, anus	6	32	113	207	235	222	63	30	908
Liver, biliary passage	2	1	21	54	90	65	32	5	270
Pancreas	1	4	11	37	56	31	14	4	158
Mesentery, peritoneum	3	3	11	17	7	7	1		49
Respiratory system	13	20	103	253	223	90	25	20	747
Larynx	2	4	27	87	72	41	10	8	251
Lungs, pleura	8	13	51	138	136	49	13	8	416
Others	3	3	25	28	15		2	4	80

TABLE 4.—*Distribution of cases of cancer by age and primary site, Cook County, Ill., 1937*—Continued

Primary site	Under 24	25–34	35–44	45–54	55–64	65–74	75 and over	Unknown	Total
Genito-urinary system	22	189	679	989	922	743	246	53	3,843
Uterus	8	129	440	616	448	229	50	27	1,942
Kidneys	11	6	29	61	57	23	3	1	191
Bladder	1	9	60	141	150	160	49	5	575
Prostate		3	7	42	148	248	120	9	577
Others	7	42	143	129	119	83	24	11	558
Breast	12	99	434	649	527	305	78	57	2,161
Skin	25	29	145	271	333	268	144	111	1,326
Brain	30	13	37	32	25	3		1	141
Bones (except jaw)	48	19	48	47	48	20	6	3	239
Others	39	54	140	183	166	128	45	29	784
Total	225	536	2,120	3,546	3,629	2,717	994	393	14,160

TABLE 5.—*Number of reported cases of cancer alive at the end of the study year, by the number of months since first diagnosis and primary site, Cook County, Ill., 1937*

Primary site	Under 6	6–11	12–17	18–23	24–29	30–35	36–41	42–47	48–53	54–59	60 and over	Unknown	Total
Buccal cavity, pharynx	221	182	82	49	23	25	23	16	4	7	40	1	679
Lip	91	74	39	21	8	9	9	5	2	2	13	1	274
Tongue	44	37	14	11	4	3	3	2	1	2	15		136
Mouth	18	11	2	6		2	1	1			6		47
Jaw	30	16	7	4	2	6	1	2			3		71
Pharynx	7	2	2		1	1	1				1		15
Others	31	42	18	7	8	4	8	6	1	3	8		136
Digestive tract	774	453	125	83	31	33	13	12	6	7	45	1	1,583
Esophagus	49	15	3	2	3	1		1			2		76
Stomach, duodenum	264	136	25	18	5	4	3		3	2	4		464
Intestines	162	122	39	17	6	13	3	2	1	2	16	1	384
Rectum, anus	207	146	50	39	15	13	7	9	2	3	19		510
Liver, biliary passage	50	18	2	4		1					3		78
Pancreas	29	12	4	2	1	1					1		50
Mesentery, peritoneum	13	4	2	1	1								21
Respiratory system	143	80	23	16	14	10	4	5	1		11		307
Larynx	59	50	7	9	11	5	2	1			8		152
Lungs, pleura	69	23	11	7	1	1		1			2		115
Others	15	7	5		2	4	2	3	1		1		40
Genito-urinary system	740	601	221	172	81	78	54	44	35	23	107	3	2,150
Uterus	376	326	131	108	53	53	36	23	21	13	65	3	1,208
Kidneys	36	26	12	2	1	5					3		85
Bladder	105	86	30	19	12	9	4	6	7	4	17		299
Prostrate	116	76	26	22	6	4	3	5	1		4		263
Others	107	87	22	21	9	7	11	10	6	6	18		304
Breast	464	385	148	114	75	40	50	41	29	24	112	4	1,495
Skin	340	293	112	66	47	27	24	16	14	12	79	1	1,031
Brain	32	18	9	5	1						3		68
Bones (except jaw)	48	45	11	9	7	5	3	2	2	1	9		142
Others	159	129	40	32	14	15	8	6	4	5	17		429
Total	2,921	2,186	771	546	293	233	188	142	95	79	429	10	7,893

TABLE 6.—*Number of reported cases of cancer dying during the study year, by the number of months since first diagnosis and primary site, Cook County, Ill., 1937*

Primary site	Under 6	6–11	12–17	18–23	24–29	30–35	36–41	42–47	48–53	54–59	60 and over	Unknown	Total
Buccal cavity, pharynx	93	65	21	8	9	8	4	3	2	1	2	1	217
Lip	12	7	1	3	4	3	1	2	1	----	1	----	35
Tongue	30	27	6	4	2	1	1	1	----	----	----	----	72
Mouth	5	1	1	1	----	----	1	----	----	----	----	----	9
Jaw	12	6	5	----	1	1	----	----	----	1	----	----	26
Pharynx	12	8	2	----	----	2	----	----	1	----	----	----	25
Others	22	16	6	----	2	1	1	----	----	----	1	1	50
Digestive tract	1,358	284	106	35	18	18	10	4	1	3	17	5	1,859
Esophagus	110	23	8	2	1	1	----	1	----	----	1	1	148
Stomach, duodenum	520	109	29	10	6	6	2	----	----	2	6	1	691
Intestines	329	53	35	5	4	4	3	2	1	----	6	2	444
Rectum, anus	171	47	28	15	6	6	4	----	----	1	3	1	282
Liver, biliary passage	138	30	3	----	1	1	1	----	----	----	1	----	175
Pancreas	73	18	2	3	----	----	----	1	----	----	----	----	97
Others	17	4	1	----	----	----	----	----	----	----	----	----	22
Respiratory system	268	61	25	5	4	2	----	----	----	----	3	1	369
Larynx	43	22	12	1	----	1	----	----	----	----	----	----	79
Lungs, pleura	209	34	10	4	3	----	----	----	----	----	3	1	264
Others	16	5	3	----	1	1	----	----	----	----	----	----	26
Genito-urinary system	606	226	95	39	37	12	13	8	5	3	23	2	1,069
Uterus	188	96	49	24	14	5	8	2	4	1	10	----	401
Kidneys	53	15	5	3	3	----	1	----	----	----	2	----	82
Bladder	130	33	9	1	4	2	2	3	1	1	3	----	189
Prostate	139	42	14	7	11	3	1	1	----	1	3	1	223
Others	96	40	18	4	5	2	1	2	----	----	5	1	174
Breast	151	62	37	28	19	13	8	9	6	5	32	3	373
Skin	39	23	7	9	3	----	----	3	3	1	4	----	92
Brain	35	7	2	----	1	----	----	----	----	----	1	1	47
Bones (except jaw)	33	17	11	1	2	----	1	----	1	----	2	2	70
Others	137	43	25	9	5	2	2	----	2	1	4	3	233
Total	2,720	788	329	134	98	55	38	27	20	14	88	18	4,329

DISABLING MORBIDITY AMONG INDUSTRIAL WORKERS, FINAL QUARTER OF 1939 AND THE ENTIRE YEAR[1]

By WILLIAM M. GAFAFER, *Senior Statistician, United States Public Health Service*

The basic data upon which this paper depends are derived from periodic reports on sickness and nonindustrial injuries causing disability lasting more than 1 week among approximately 170,000 male members of industrial sick benefit organizations. These organizations comprise mutual sick benefit associations, group insurance plans, and company relief departments. The companies are located in Pennsylvania, Illinois, Massachusetts, Connecticut, New York, Ohio, Maine, South Dakota, New Jersey, and Canada.

The year 1939.—According to table 1 the frequency for 1939 of all sickness and nonindustrial injuries causing disability for 8 consecutive calendar days or longer was 88.8 per 1,000 men, a slight increase when compared with the corresponding frequency (82.2) for 1938. The cause group principally responsible for this increase

[1] From the Division of Industrial Hygiene, National Institute of Health. For the third quarter of 1939 see PUBLIC HEALTH REPORTS, 55: 1–3 (January 5, 1940).

appears to be influenza and grippe, with a frequency of 16.5 in 1939 and 9.9 in 1938, the former rate reflecting primarily the first quarter rate of 40.0.

TABLE 1.—*Frequency of cases of sickness and nonindustrial injuries lasting 8 consecutive calendar days or longer among male employees in various industries, by cause, the fourth quarter of 1939 compared with the fourth quarter of 1938, and the full year of 1939 compared with the full years 1934–38, inclusive* [1]

[Male morbidity experience of industrial companies which reported their cases to the United States Public Health Service]

Cause (numbers in parentheses are disease title numbers from the International List of Causes of Death, 1929)	Annual number of cases per 1,000 males				
	Fourth quarter		Full year		
	1939	1938	1939	1938	1934–38
Sickness and nonindustrial injuries [2]	77.2	81.4	88 8	82.2	87.9
Nonindustrial injuries (163–198, 201–214)	10.2	10.6	10.2	11.0	11.5
Sickness [2]	67.0	70.8	78.6	71.2	76.4
Respiratory diseases	27.5	28.2	34.1	26 6	31.8
Influenza and grippe (11)	10.3	10.8	16.5	9.9	14.1
Bronchitis, acute and chronic (106)	4.6	5.1	4.2	4.3	4.2
Diseases of the pharynx and tonsils (115a)	3.7	3.8	4.4	4.5	4.4
Pneumonia, all forms (107–109)	3.0	2.9	3.0	2.3	2.8
Tuberculosis of the respiratory system (23)	.5	.8	.7	.9	.9
Other respiratory diseases (104, 105, 110–114)	5.4	4.8	5.3	4.7	4.9
Nonrespiratory diseases	37.9	40.7	42.5	42.5	42.7
Digestive diseases	10.9	13.4	13.3	13.4	13.4
Diseases of the stomach, except cancer (117, 118)	3 2	4.2	3.5	4.1	3.8
Diarrhea and enteritis (120)	1.0	1.1	1.2	1.0	1.2
Appendicitis (121)	3.7	3.5	4.3	4.0	4.1
Hernia (122a)	1.0	1.4	1.5	1.0	1.6
Other digestive diseases (115b, 116, 122b–129)	2.0	3.2	2.8	2.7	2.7
Nondigestive diseases	27.0	27.3	29.2	29.1	29.3
Diseases of the heart and arteries, and nephritis (90–99, 102, 130–132)	4.4	4.1	4.4	4.1	3.8
Other genitourinary diseases (133–138)	2.0	2.1	2.3	2.3	2.4
Neuralgia, neuritis, sciatica (87a)	2.3	2.2	2.2	2.1	2.1
Neurasthenia and the like (part of 87b)	1.0	1.0	1.0	.9	1.0
Other diseases of the nervous system (78–85, part of 87b)	1.0	1.1	1.0	1.2	1.2
Rheumatism, acute and chronic (56, 57)	2.7	3.3	3.4	3.7	4.0
Diseases of the organs of locomotion, except diseases of the joints (156b)	2.6	3.0	2.6	2.8	2.9
Diseases of the skin (151–153)	2.5	2.5	2.7	3.0	2.9
Infectious and parasitic diseases (1–10, 12–22, 24–33, 36–44)	1.5	1.4	2.1	2.1	2.5
All other diseases (45–55, 58–77, 88, 89, 100, 101, 103, 154–156a, 157, 162)	7.0	6.6	7.5	6.9	6.5
Ill-defined and unknown causes (200)	1.6	1.9	2.0	2.1	2.4
Average number of males covered in the record	192,211	167,894	177,333	167,915	161,193
Number of organizations	26	26	26	26	

[1] In 1939 and 1938 the same organizations are included; the rates for the years 1934–38, however, are based on records from the same 26 organizations and some additional reporting organizations.
[2] Exclusive of disability from the venereal diseases and a few numerically unimportant causes of disability.

Of interest also is the increase of 30 percent shown by the annual frequency for pneumonia, all forms; however, when the rate for 1939 is compared with the corresponding frequency for 1934–38 the increase becomes very much reduced. The question arises as to the relative position of the pneumonia rate for 1939 among the annual rates recorded for previous years.

Pneumonia, 1930–39.—The pertinent rates are given for the years 1930–39 in the following table. In addition each annual rate is shown in terms of the average rate for the entire period. It will be observed that the annual rate for 1939 (3.0) is the highest recorded for the decade, while the lowest rate (1.8) occurred in 1933. The 10 annual rates vary about a mean of 2.4, beginning with the relatively high rate of 2.6 in 1930, decreasing to 1.8 in 1933, gradually rising to 2.9 in 1937, dropping precipitously to 2.3 in 1938, and rising again to the maximum of 3.0.

Item	1930–39	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Pneumonia rate per 1,000	2 4	2 6	2 1	2 0	1 8	1 9	2 3	2 6	2 9	2 3	3 0
Ratio of rate to rate for 1930–39	1 00	1 08	0 88	0.83	0 75	0 79	0 96	1.08	1 21	0 96	1 25

Of interest is the variation of the annual rates in terms of the average rate for the entire 10 years. It will be seen that the rate varies within a band determined by the 25-percent defect for 1933 and the 25-percent excess for 1939. The initial rate of the 10-year period shows an excess of 8 percent, an excess which is again reached in 1936 after a decrease and a rise. Thereafter the rate rises to an excess of 21 percent for the year 1937. The following year, 1938, which was an unusually favorable year with respect to all causes, shows a defect of 4 percent which in 1939 becomes an excess of 25 percent.

The years 1934–38.—A comparison of the rates for 1939 with the corresponding ones for 1934–38, which are shown in table 1, reveals only a slight difference for all sickness and nonindustrial injuries. However, the rates for influenza and grippe, and diseases of the heart and arteries, including nephritis, are unfavorable.

Final quarter of 1939.—An examination of the fourth quarter frequencies shows favorable rates for 1939 as compared with 1938 for diseases of the stomach except cancer, hernia, and rheumatism, acute and chronic. The rheumatic group, on the other hand, which is generally defined in these reports as including neuralgia, neuritis, and sciatica, rheumatism, acute and chronic, and diseases of the organs of locomotion, except diseases of the joints, shows only a small decrease in frequency, namely, from 8.5 to 7.6.

THE NEED FOR INTENSIVE EDUCATIONAL CAMPAIGNS IN CANCER CONTROL

For some years educational campaigns designed to enlighten the people regarding cancer have been conducted by the American Society for the Control of Cancer, the United States Public Health Service, the State health departments, State cancer commissions, and the American Medical Association. The fundamental purpose of such informational activity has been to encourage early diagnosis and treatment, to supplant misconceptions with helpful knowledge, and to overcome resort to quackery. In view of these efforts, it is of interest to those so engaged, and of especial value in the orientation of future efforts, to have a measure of the success of educational campaigns and to know where they have failed. We have an index of this measure in the recent survey made by the American Institute of Public Opinion, in cooperation with the American Society for the Control of Cancer.

The poll was made, by means of questionnaires, of men and women in all parts of the United States. Within the limits of the population surveyed, which may have certain selective features but is assumed to be fairly representative, the lack of important, accurate, helpful information regarding cancer, as well as the amount of misinformation, is somewhat astounding. The following are the questions and the distributed percentages of the answers.

1. *Do you think that cancer is curable?*

	Percent
Believed curable if treated in time	56
Believed incurable	27
Don't know	17

Since only 49 percent thought cancer to be curable in the survey made a year ago, the present figures indicate substantial improvement with respect to general knowledge on this point. Applying the difference in the percentages to the entire adult population, it is indicated that 5,500,000 more men and women have been reached with this important knowledge that may result in the saving of life.

2. *Do you think that cancer is contagious?*

	Percent
Believe cancer not contagious	57
Believe it to be contagious	15
Don't know	28

As 20 percent believed cancer to be contagious in the poll made one year ago, some improvement has been made in enlightenment on this point.

3. *What do you think causes cancer?*

About one-half of the persons polled had some theory, while the other half had no opinion. The most frequently named causes, in the

order mentioned, were bruises, injuries, constant irritation of body tissues, sores, and tumors. Other replies revealed a mixture of sound information and error.

The next question is one in which the results of the poll especially indicate a field for greater educational effort.

4. *Do you happen to know any of the symptoms of cancer?* The replies were:

	Percent
Yes	38
No	62

These figures would indicate that only a little more than one-third of the people in the United States have yet been educated to recognize the symptoms of cancer.

5. *Do you think that there is anything shameful in having cancer?*

	Percent
No	98
Yes	2

It is an encouraging and optimistic note to know that people no longer consider it a disgrace to be afflicted with cancer, and are thus less likely to conceal it and more likely to secure early treatment.

The replies to the next question were not only of interest with respect to general knowledge regarding cancer, but they very forcibly reveal the effect, on the public mind, of the open attack on the venereal diseases. A year ago 76 percent of the persons polled considered cancer the greatest public health problem, whereas in the present survey syphilis took the lead. The question, however, may be open to some criticism regarding interpretation. It was

6. *In your opinion which of the following-named diseases is the most serious public health problem?* The replies were:

	Percent
Syphilis	46
Cancer	29
Tuberculosis	16
Infantile paralysis	9

Although the results of the poll show encouraging progress in public enlightenment regarding cancer, they also reveal that widespread misconceptions still prevail and that much work still remains to be done.

With regard to curability of cancer if detected in time, there is yet much to be done in the diffusion of helpful knowledge. It would be interesting to learn how many people are aware that there are today only two known methods of treatment—surgery and radiation—and how many believe in the efficacy of salves and serums.

With regard to opinions on the causes of cancer, the survey reveals the prevalence of many misconceptions. The much publicized and absolutely erroneous idea that aluminum cooking utensils are respon-

sible still persists and is apparently difficult to eradicate. The same is true of some other alleged causes.

While research workers are actively engaged in solving the mystery that still surrounds the etiology of cancer, and attempting to devise specific measures for treatment and prevention—hopes that, in view of the multiple fields of intensive research, may in the future be realized—it is incumbent upon public health authorities and others concerned with public health education to disseminate useful, practical knowledge regarding the disease and to spread the gospel of hope.

Diagnostic service and treatment facilities are being provided in many clinics throughout the country. In 1939 the American College of Surgeons had records of at least 30,000 cancer patients who had remained cured for a 5-year period. In 1938 cancer caused nearly 150,000 deaths in the United States. It is estimated that ideal application of present knowledge of control would reduce the cancer mortality rate by 25 percent. Help for the other 115,000 fatal cases annually must depend upon the acquisition of new knowledge through research.

COURT DECISION ON PUBLIC HEALTH

Guaranty to dealer that a food or drug is not adulterated or misbranded under a State's statutes.—(Massachusetts Supreme Judicial Court; *Commonwealth* v. *Johnson Wholesale Perfume Co., Inc.*, 24 N.E.2d 8; decided December 1, 1939.) The defendant company sold to an inspector of the State department of public health a drug which was "adulterated or misbranded" within the meaning of a statute dealing with the adulteration and misbranding of food and drugs. The defendant sold the drug in the original unbroken package in which it had received the same. The statute provided that no dealer should be prosecuted, under sections of the statute dealing with adulteration or misbranding, for selling any article of food or drug in the original unbroken package in which it was received by him if he could establish a guaranty by the wholesaler, jobber, manufacturer, or other person residing in the United States, from whom he purchased the article, to the effect that the same was not adulterated or misbranded within the meaning of the State laws. The statute also provided that such guaranty, to afford protection, should contain the name and address of the person making the sale of the article to the dealer. A regulation of the State department of public health required that a guaranty given under the statutory provision should also, in order to protect the person receiving it, be signed by the party selling to the dealer.

The defendant company had a guaranty covering the drug sold to the health department inspector, which guaranty complied with the provisions of the statute but did not comply with the department's

regulation in that it was not signed by the guarantor. The question presented to the supreme court was whether the lack of the guarantor's signature deprived the defendant of the immunity from prosecution given by the statute. In deciding in the defendant's favor the court said that it thought that the language of the statute, viewed with the history of the statutes giving immunity to dealers, adequately indicated that the legislature intended to give the protection of the immunity statute to a dealer who had a guaranty of the kind described in the statute without requiring that the guaranty be signed. A concluding paragraph of the opinion read:

> The statute in section 193 has specified fully the requirements of the legislature as to the character of a guaranty which shall afford immunity from prosecution to a dealer who has sold the articles mentioned in the statute and made a signed guaranty unnecessary. When a subject has been fully regulated by statute an administrative board cannot further regulate it by the adoption of a regulation which is repugnant to the statute. * * *

DEATHS DURING WEEK ENDED MARCH 23, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Mar. 23, 1940	Corresponding week, 1939
Data from 88 large cities of the United States.		
Total deaths	8,964	9,213
Average for 3 prior years	9,188	
Total deaths, first 12 weeks of year	113,972	114,003
Deaths under 1 year of age	403	545
Average for 3 prior years	567	
Deaths under 1 year of age, first 12 weeks of year	6,197	6,667
Data from industrial insurance companies:		
Policies in force	65,910,665	67,733,216
Number of death claims	12,988	17,850
Death claims per 1,000 policies in force, annual rate	10.3	13.7
Death claims per 1,000 policies, first 12 weeks of year, annual rate	10.7	11.2

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED APRIL 6, 1940

Summary

The incidence of each of the 9 diseases reported to the United States Public Health Service weekly by telegraph by the State health officers was below the median expectancy (1935–39) for the current week with the exception of poliomyelitis. All of these diseases except measles, poliomyelitis, and whooping cough showed a decrease from the preceding week, and all except poliomyelitis and scarlet fever were below the figures for the corresponding week last year.

The accumulated totals for the first 14 weeks of the current year, the period ending with the current week, are below the median expectancy for all of these diseases except influenza and poliomyelitis. As a further indication of favorable health conditions in the United States so far this year, the total number of deaths and infant mortality in 88 large cities, as reported to the Bureau of the Census, up to March 30, are below the figures for 1939. Neither in 1939 nor in the current year, however, are these figures as low as in 1938, a year which recorded the lowest mortality rate in the history of the country.

While the incidence of all of the nine important communicable diseases included in the following table is low, especially favorable conditions obtain with respect to diphtheria, measles, meningococcus meningitis, scarlet fever, smallpox, and typhoid fever. The accumulated total for smallpox is less than one-fourth, of measles less than one-half, and of meningococcus meningitis less than one-third of the median expectancy for the 5-year period 1935–39, while diphtheria is about 64 percent and typhoid fever about 65 percent of the median.

For the current week, 14 cases of endemic typhus fever were reported, 2 cases of encephalitis in South Carolina, 1 case of undulant fever in Maryland and 1 in Utah, and 3 cases of Rocky Mountain spotted fever in western States. California and Texas each reported 4 cases of poliomyelitis.

Telegraphic morbidity reports from State health officers for the week ended April 6, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	Apr. 6, 1940	Apr. 8, 1939		Apr. 6, 1940	Apr. 8, 1939		Apr. 6, 1940	Apr. 8, 1939		Apr. 6, 1940	Apr. 8, 1939	
NEW ENG.												
Maine	1	3	1	-------	73	6	668	15	92	0	0	0
New Hampshire	1	0	0	-------	-------	-------	41	3	29	0	0	0
Vermont	0	1	0	-------	-------	-------	8	45	45	0	0	0
Massachusetts	0	2	3	-------	-------	-------	472	949	736	1	0	1
Rhode Island	0	0	0	-------	-------	-------	203	30	48	0	1	1
Connecticut	0	0	4	8	10	10	83	890	799	1	0	2
MID. ATL.												
New York	18	15	33	[1] 11	[1] 22	[1] 17	668	1,563	2,909	1	3	10
New Jersey	1	9	13	6	3	13	462	34	1,562	1	0	1
Pennsylvania	24	28	37	-------	-------	-------	264	151	721	7	4	5
E. NO. CEN.												
Ohio	12	12	14	67	-------	16	25	18	424	0	0	4
Indiana	6	16	13	16	69	69	59	23	137	5	0	5
Illinois	22	27	37	22	63	61	63	33	85	0	2	2
Michigan [2]	3	12	12	22	20	12	388	409	409	0	1	1
Wisconsin	1	1	2	175	533	49	469	657	657	1	4	2
W. NO. CEN.												
Minnesota	1	2	5	2	1	1	160	408	361	0	1	1
Iowa	2	10	8	4	202	6	135	231	194	0	0	1
Missouri	9	17	23	4	11	56	29	18	55	0	0	1
North Dakota	0	0	0	12	124	24	5	79	24	0	1	0
South Dakota [2]	0	0	0	5	43	-------	3	179	2	0	0	0
Nebraska	5	1	1	-------	-------	-------	13	173	127	0	0	1
Kansas	5	3	5	19	32	6	582	43	43	1	1	1
SO. ATL.												
Delaware	1	0	1	-------	-------	-------	3	0	22	0	0	0
Maryland [2]	0	1	6	25	12	16	5	497	292	0	0	5
Dist. of Col.	1	5	5	-------	3	1	2	167	72	0	0	2
Virginia	16	15	13	292	759	-------	82	479	438	1	3	5
West Virginia [2]	9	8	8	171	528	120	7	21	30	1	1	3
North Carolina	17	15	15	33	34	34	163	810	342	0	2	4
South Carolina [2]	9	2	2	552	846	303	16	32	39	0	1	1
Georgia [2]	8	4	4	168	880	344	150	194	0	0	1	1
Florida	5	7	7	6	-------	2	124	160	77	0	0	1
E. SO. CEN.												
Kentucky	4	7	8	13	243	36	146	19	448	1	0	6
Tennessee	1	5	5	140	440	141	84	83	82	1	3	5
Alabama [2]	5	10	10	172	978	648	113	169	169	1	2	7
Mississippi [2 3]	8	4	4	-------	-------	-------	-------	-------	-------	2	2	1
W. SO. CEN.												
Arkansas	3	2	6	134	400	82	10	47	47	3	1	1
Louisiana	6	11	9	45	19	19	34	151	67	0	0	1
Oklahoma	4	5	13	68	308	124	17	168	112	1	0	2
Texas [3]	24	30	42	882	2,285	792	890	301	423	6	0	2
MOUNTAIN												
Montana [4]	2	0	0	-------	55	39	16	191	39	0	0	1
Idaho	1	0	0	2	15	4	35	123	15	0	0	0
Wyoming	1	1	0	1	-------	-------	43	110	46	0	0	0
Colorado [5]	12	17	5	34	20	-------	31	298	166	0	0	1
New Mexico	0	5	3	-------	18	14	50	34	54	0	0	0
Arizona	0	5	1	122	327	90	104	11	63	0	0	1
Utah [2]	0	0	0	4	102	-------	498	102	33	0	0	0
PACIFIC												
Washington	1	0	2	2	-------	1	1,014	643	262	2	1	1
Oregon [4]	13	2	1	22	139	81	592	54	54	0	0	1
California [2]	9	21	27	151	123	123	352	2,632	1,313	2	2	5
Total	271	341	444	3,412	9,740	3,931	9,381	13,447	13,447	39	37	139
14 weeks	5,213	6,907	8,149	152,441	123,386	108,246	86,250	181,278	181,278	559	719	1,826

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 6, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Apr. 6, 1940	Apr. 8, 1939		Apr. 6, 1940	Apr. 8, 1939		Apr. 6, 1940	Apr. 8, 1939		Apr. 6, 1940	Apr. 8, 1939	
NEW ENG.												
Maine	0	0	0	11	15	15	0	0	0	0	3	3
New Hampshire	0	0	0	0	7	9	0	0	0	0	0	0
Vermont	0	0	0	9	12	12	0	0	0	0	1	0
Massachusetts	0	0	0	185	182	274	0	0	0	0	2	2
Rhode Island	0	0	0	22	12	25	0	0	0	0	0	0
Connecticut	0	0	0	117	91	130	0	0	0	3	1	1
MID. ATL.												
New York	0	3	2	920	662	1,036	0	0	0	6	6	5
New Jersey	0	0	0	371	149	171	0	0	0	0	3	2
Pennsylvania	1	1	0	406	349	602	0	0	0	7	10	9
E. NO. CEN.												
Ohio	1	1	0	363	361	361	1	9	3	4	1	4
Indiana	0	0	0	206	191	204	2	15	9	2	0	0
Illinois	2	3	1	952	487	763	5	6	8	1	3	4
Michigan [2]	0	0	0	365	413	413	0	16	9	2	3	3
Wisconsin	1	0	0	81	241	351	1	4	4	1	1	1
W. NO. CEN.												
Minnesota	0	0	0	74	51	166	2	5	5	0	0	0
Iowa	0	0	0	35	115	221	11	40	40	2	1	1
Missouri	0	0	0	111	86	115	0	23	23	1	2	2
North Dakota	0	0	0	15	12	30	1	1	3	1	2	0
South Dakota [2]	0	0	0	17	18	18	2	5	6	1	1	0
Nebraska	0	0	0	13	34	42	3	11	11	0	0	0
Kansas	1	0	0	61	78	142	0	2	20	1	0	1
SO. ATL.												
Delaware	0	0	0	8	5	5	0	0	0	0	0	0
Maryland [2]	0	0	0	50	25	60	0	0	0	0	3	3
Dist. of Col.	1	0	0	17	18	18	0	0	0	1	0	1
Virginia	1	0	0	71	49	38	0	0	0	4	4	3
West Virginia [2]	1	1	0	53	27	55	0	0	0	2	2	2
North Carolina	0	0	1	31	37	32	0	1	1	0	5	4
South Carolina [2]	0	5	0	6	2	5	2	1	0	0	3	1
Georgia [3]	0	1	0	10	5	7	0	0	0	3	1	1
Florida	1	1	0	9	7	7	0	0	0	1	5	4
E. SO. CEN.												
Kentucky	0	0	0	89	72	58	0	1	1	6	3	3
Tennessee	1	1	0	91	58	30	1	0	0	3	2	6
Alabama [3]	1	0	0	12	9	9	0	0	1	2	2	3
Mississippi [2] [3]	0	2	1	6	6	6	0	1	0	2	1	1
W. SO. CEN.												
Arkansas	1	2	0	6	10	10	1	0	1	1	3	3
Louisiana	0	0	0	12	5	9	0	0	1	2	19	11
Oklahoma	0	0	0	16	22	22	3	24	3	1	0	1
Texas [3]	4	0	0	49	60	60	3	18	18	7	9	16
MOUNTAIN												
Montana [4]	0	0	0	22	12	16	0	0	6	1	1	1
Idaho	1	1	0	14	17	17	0	4	4	0	1	0
Wyoming	0	0	0	4	16	17	0	0	5	0	0	0
Colorado [3]	0	0	0	35	34	38	4	3	5	2	0	0
New Mexico	0	0	0	22	3	16	1	1	0	2	2	2
Arizona	0	1	0	7	11	23	0	3	1	0	4	1
Utah [3]	0	0	0	14	30	47	1	0	0	0	0	0
PACIFIC												
Washington	0	0	0	57	37	37	3	4	15	2	0	0
Oregon [4]	0	1	0	20	30	53	0	6	6	0	4	3
California [3]	4	0	1	123	182	208	0	9	9	4	1	2
Total	22	24	17	5,188	4,355	6,992	47	213	261	78	115	128
14 weeks	375	211	293	66,711	73,326	95,374	1,001	5,115	4,333	1,080	1,642	1,642

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 6, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended— Apr. 6, 1940	Whooping cough, Week ended— Apr. 8, 1939
NEW ENG.		
Maine	61	86
New Hampshire	21	1
Vermont	31	44
Massachusetts	132	206
Rhode Island	8	54
Connecticut	26	85
MID. ATL.		
New York	401	501
New Jersey	116	234
Pennsylvania	270	262
E. NO. CEN.		
Ohio	180	133
Indiana	21	38
Illinois	148	256
Michigan [2]	114	148
Wisconsin	82	279
W. NO. CEN.		
Minnesota	30	22
Iowa	11	10
Missouri	33	23
North Dakota	0	25
South Dakota [2]	5	2
Nebraska	1	8
Kansas	32	19
SO. ATL.		
Delaware	15	11
Maryland [2]	216	25
Dist. of Col.	14	33
Virginia	58	51
West Virginia [2]	124	34
North Carolina	106	293
SO. ATL.—continued		
South Carolina [3]	31	97
Georgia [3]	42	29
Florida	16	58
E. SO. CEN.		
Kentucky	115	13
Tennessee	43	13
Alabama [3]	23	39
Mississippi [2] [3]		
W. SO. CEN.		
Arkansas	3	33
Louisiana	5	2
Oklahoma	10	4
Texas [3]	284	108
MOUNTAIN		
Montana [4]	6	6
Idaho	5	2
Wyoming	3	0
Colorado [5]	2	60
New Mexico	70	8
Arizona	30	0
Utah [2]	109	22
PACIFIC		
Washington	64	15
Oregon [4]	29	12
California [3]	372	152
Total	3,521	3,562
14 weeks	41,351	58,313

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Apr. 6, 1940, 14 cases as follows: South Carolina, 2; Georgia, 3; Alabama, 3; Mississippi, 1; Texas, 4; California, 1.
[4] Rocky Mountain spotted fever, week ended Apr. 6, 1940, 3 cases as follows: Montana, 1; Oregon, 2.
[5] Colorado tick fever, week ended Apr. 6, 1940, Colorado, 2 cases.

WEEKLY REPORTS FROM CITIES

City reports for week ended March 23, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	152	526	114	8,054	881	2,464	29	391	22	1,246	------
Current week [1]	74	252	74	1,935	537	2,084	0	336	16	838	------
Maine:											
Portland	0	------	0	63	3	0	0	1	0	2	22
New Hampshire:											
Concord	0	------	0	1	0	0	0	0	0	0	12
Manchester	0	------	1	10	1	0	0	0	0	0	18
Nashua	0	------	0	52	0	0	0	0	0	0	7
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	1	12
Rutland	0	------	0	0	0	0	0	0	0	0	8
Massachusetts:											
Boston	1	------	1	52	13	48	0	6	0	39	246
Fall River	0	------	0	14	1	2	0	0	0	2	39
Springfield	0	------	0	1	1	5	0	0	0	7	41
Worcester	0	------	0	7	5	2	0	1	0	2	55
Rhode Island:											
Providence	0	1	0	81	4	12	0	2	0	2	79
Connecticut:											
Bridgeport	0	1	1	0	1	1	0	0	0	0	32
Hartford	0	------	0	0	3	3	0	0	4	4	37
New Haven	1	5	0	1	2	1	0	0	0	0	40
New York:											
Buffalo	0	------	1	1	11	12	0	6	0	5	131
New York	18	28	6	74	120	794	0	84	0	124	1,621
Rochester	1	5	0	4	1	11	0	3	0	12	74
Syracuse	0	------	0	0	4	10	0	1	0	9	64
New Jersey:											
Camden	0	1	1	0	4	11	0	0	0	0	35
Newark	0	2	0	119	5	32	0	4	0	19	108
Trenton	0	------	1	0	3	4	0	2	0	0	39
Pennsylvania:											
Philadelphia	1	------	2	26	32	95	0	22	5	16	511
Pittsburgh	2	2	2	5	8	26	0	5	1	4	171
Reading	0	------	0	1	2	0	0	1	0	7	29
Scranton	0	------	------	1	------	3	0	------	0	0	------
Ohio:											
Cincinnati	0	------	2	0	6	7	0	3	0	6	142
Cleveland	1	33	4	4	19	24	0	8	0	27	208
Columbus	0	1	1	2	3	4	0	1	0	4	93
Toledo	0	------	0	1	4	38	0	10	0	7	101
Indiana:											
Anderson	0	------	0	0	1	4	0	0	0	9	11
Fort Wayne	0	------	0	0	1	2	0	0	0	0	29
Indianapolis	3	------	1	4	4	27	0	5	0	7	107
Muncie	0	------	1	0	2	3	1	0	0	0	22
South Bend	0	------	0	0	5	0	0	0	0	4	16
Terre Haute	------	------	------	------	------	------	------	------	------	------	------
Illinois:											
Alton	0	------	0	1	1	2	0	0	0	3	15
Chicago	8	7	5	33	20	530	0	43	0	43	745
Elgin	0	------	0	1	1	3	0	0	0	0	10
Moline	0	------	0	0	0	3	0	0	0	0	14
Springfield	0	------	0	1	2	3	0	0	0	1	20
Michigan:											
Detroit	1	2	1	19	15	67	0	10	3	32	257
Flint	0	------	1	0	5	27	0	0	0	12	19
Grand Rapids	------	------	------	------	------	------	------	------	------	------	------
Wisconsin:											
Kenosha	0	------	0	10	0	2	0	0	0	0	8
Madison	0	------	0	0	0	0	0	0	0	1	15
Milwaukee	0	------	0	8	4	25	0	0	0	0	102
Racine	0	------	0	1	0	1	0	0	0	0	11
Superior	0	------	0	58	0	2	0	0	0	0	10

[1] Figures for Barre, Terre Haute, and Grand Rapids estimated; reports not received.

City reports for week ended March 23, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	1	104	1	1	0	1	0	0	26
Minneapolis	0	------	0	1	3	14	0	1	0	2	79
St. Paul	0	------	0	3	7	10	0	0	0	6	60
Iowa:											
Cedar Rapids	0	------	------	17	------	1	0	------	0	1	------
Davenport	0	------	------	9	------	3	0	------	0	0	------
Des Moines	1	------	0	4	0	4	3	0	0	0	41
Sioux City	0	------	------	0	------	0	0	------	0	0	------
Waterloo	1	------	------	1	------	2	0	------	0	0	------
Missouri:											
Kansas City	0	1	3	2	5	22	0	3	0	0	99
St. Joseph	0	------	1	0	2	2	0	0	0	1	24
St. Louis	1	------	0	1	10	19	0	7	0	11	188
North Dakota:											
Fargo	0	------	0	2	0	0	0	0	0	0	8
Grand Forks	0	------	------	0	------	0	0	------	0	0	------
Minot	1	------	0	1	0	2	0	0	0	0	7
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	2	------
Nebraska:											
Lincoln	1	------	------	1	------	2	0	------	0	0	------
Omaha	0	------	0	4	6	7	0	2	0	1	58
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	5
Topeka	0	------	0	1	3	2	0	0	0	0	12
Wichita	1	------	0	268	4	1	0	1	0	2	25
Delaware:											
Wilmington	0	------	0	0	4	2	0	1	0	3	32
Maryland:											
Baltimore	0	18	1	1	26	13	0	8	0	242	237
Cumberland	0	------	0	0	0	0	0	0	0	0	13
Frederick	0	------	0	0	0	0	0	0	0	0	1
Dist. of Col.:											
Washington	13	2	1	1	13	37	0	10	1	14	198
Virginia:											
Lynchburg	0	------	1	1	0	0	0	0	0	6	9
Norfolk	1	36	0	10	2	2	0	2	0	0	33
Richmond	0	------	3	0	1	1	0	2	0	1	53
Roanoke	0	------	0	0	2	1	0	0	0	0	11
West Virginia:											
Charleston	1	8	0	0	5	1	0	1	0	0	16
Huntington	1	------	------	0	------	2	0	------	0	0	------
Wheeling	0	------	0	0	3	1	0	0	0	0	28
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	1	------	0	0	0	0	0	1	0	0	17
Wilmington	0	------	0	0	1	1	0	0	0	0	15
Winston-Salem	0	------	0	0	2	2	0	2	0	0	22
South Charleston:											
Charleston	0	18	2	1	0	0	0	1	0	0	19
Florence	0	8	1	0	2	0	0	0	0	0	14
Greenville	0	------	0	1	2	0	0	0	0	0	6
Georgia:											
Atlanta	1	16	2	16	5	2	0	7	0	2	91
Brunswick	0	------	0	1	0	1	0	0	0	0	1
Savannah	0	19	2	2	3	2	0	2	0	0	40
Florida:											
Miami	1	2	1	1	4	2	0	2	1	0	42
Tampa	1	3	2	80	1	0	0	1	0	0	28
Kentucky:											
Ashland	0	2	0	4	1	0	0	0	0	7	6
Covington	0	------	0	0	1	3	0	0	0	0	14
Lexington	0	------	0	0	1	0	0	2	0	1	18
Louisville	0	10	0	3	5	18	0	3	0	26	62
Tennessee:											
Knoxville	0	1	0	1	5	18	0	0	1	0	38
Memphis	0	------	3	7	4	19	0	5	0	12	90
Nashville	0	------	4	1	8	1	0	4	0	2	62
Alabama:											
Birmingham	1	8	3	3	3	0	0	6	0	0	69
Mobile	0	4	1	2	3	0	0	2	0	0	22
Montgomery	1	5	------	10	------	2	0	------	0	0	------
Arkansas:											
Fort Smith	0	3	------	0	------	0	0	------	0	0	------
Little Rock	0	5	1	2	5	1	0	0	0	0	------

City reports for week ended March 23, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Louisiana:											
Lake Charles	0	------	0	0	1	0	0	0	2	0	6
New Orleans	5	12	3	0	13	13	0	13	1	1	150
Shreveport	0	------	1	0	5	0	0	1	0	1	36
Oklahoma:											
Oklahoma City	0	8	2	0	1	1	0	0	0	2	42
Tulsa	0	------	------	1	------	8	0	------	0	13	------
Texas:											
Dallas	4	2	2	23	7	1	0	3	0	13	71
Fort Worth	0	------	2	1	6	4	0	3	0	18	42
Galveston	0	------	0	0	4	0	0	2	0	0	22
Houston	1	1	1	3	5	1	0	4	0	2	71
San Antonio	0	2	1	80	14	1	0	6	1	6	70
Montana:											
Billings	0	------	0	2	0	0	0	0	0	0	10
Great Falls	0	------	0	0	1	0	0	0	0	0	8
Helena	0	------	0	2	0	0	0	0	0	0	2
Missoula	1	1	0	0	2	2	0	0	0	0	10
Idaho:											
Boise	0	------	0	1	1	0	0	0	0	0	11
Colorado:											
Colorado Springs	0	------	0	0	0	0	0	0	0	0	10
Denver	4	------	0	9	8	11	0	2	0	0	80
Pueblo	0	------	0	2	3	9	0	0	0	0	9
New Mexico:											
Albuquerque	0	------	0	1	0	0	0	0	1	1	7
Utah:											
Salt Lake City	0	------	0	223	2	7	0	0	0	54	32
Washington:											
Seattle	0	------	1	445	7	2	0	2	0	21	90
Spokane	0	------	0	3	1	4	0	0	0	2	43
Tacoma	0	------	0	29	1	10	0	0	0	0	38
Oregon:											
Portland	2	1	1	244	3	1	0	1	0	13	91
Salem	0	------	------	11	------	0	0	------	0	0	------
California:											
Los Angeles	1	43	2	15	10	29	0	14	0	21	356
Sacramento	0	1	0	1	2	3	0	3	0	6	25
San Francisco	1	2	1	1	10	13	0	10	0	12	172

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Rhode Island:				District of Columbia:			
Providence	0	1	0	Washington	1	0	0
New York:				Louisiana:			
Buffalo	3	1	0	New Orleans	2	0	0
Pennsylvania:				Texas:			
Philadelphia	1	0	0	Dallas	1	1	0
Scranton	2	0	0	Montana:			
Indiana:				Great Falls	0	0	1
Indianapolis	0	0	1	California:			
Illinois:				Los Angeles	0	0	1
Chicago	3	1	0				

Encephalitis, epidemic or lethargic.—Cases: Baltimore, 1; Great Falls, 1.
Pellagra.—Cases: Birmingham, 2.
Typhus fever.—Cases: Mobile, 1; Fort Worth, 1.

FOREIGN REPORTS

CANADA

Manitoba—Typhoid fever.—Under date of March 28, 1940, it was reported that 44 cases of typhoid fever had been hospitalized in the city of St. Boniface, Manitoba, Canada. The reported area of infection was centered in St. Boniface and in the adjacent rural district of St. Anne.

Provinces—Communicable diseases—Weeks ended March 2 and 9, 1940.—During the weeks ended March 2 and 9, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Week ended March 2, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			1	2						3
Chickenpox		15	16	295	451	58	26	7	105	973
Diphtheria			2	23	1	11	3			40
Dysentery				6						6
Influenza		46			31	2			69	148
Measles			1	190	660	760	136	7	17	1,771
Mumps				31	389	34	84	1	3	542
Pneumonia		10			22		3		10	45
Poliomyelitis				2			1			3
Scarlet fever		7	5	113	187	13	30	26	8	389
Trachoma							1			1
Tuberculosis		9	16	82	48	4		1		160
Typhoid and paratyphoid fever			1	15		1				17
Whooping cough		4		137	94	34	62	11	17	359

NOTE.—No cases of the above diseases were reported from Prince Edward Island for the above period.

Week ended March 9, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis	1									1
Chickenpox		16	1	183	430	21	55	1	102	809
Diphtheria		1	1	15	2	3	3			25
Dysentery				2						2
Influenza		57			174	1			135	367
Measles		10	1	138	820	678	78	1	51	1,777
Mumps		2		52	492	13	18		2	579
Pneumonia	5	8			31	2			8	54
Scarlet fever	1	17	8	77	197	14	7	4	9	334
Trachoma							2		5	7
Tuberculosis	1	17	14	53	59	5				149
Typhoid and paratyphoid fever			1	9	1	3				14
Whooping cough		33	2	138	158	25	38	4	18	416

CUBA

Provinces—Notifiable diseases—4 weeks ended March 2, 1940.—During the 4 weeks ended March 2, 1940, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	4	2	2	5		5	18
Chickenpox	2	13	7	6	1	1	30
Diphtheria	2	13	1	1	2	2	21
Hookworm disease		31					31
Leprosy	1				2	2	5
Malaria	12			34	6	37	89
Measles		1	1	1		1	4
Poliomyelitis				1		3	4
Scarlet fever		2	3				5
Tuberculosis	17	36	29	36	12	36	166
Typhoid fever	15	50	6	18	16	44	149
Whooping cough				1			1
Yaws						5	5

ITALY

Communicable diseases—4 weeks ended December 31, 1939.—For the 4 weeks ended December 31, 1939, cases of certain communicable diseases were reported in Italy as follows:

Disease	Dec. 4-10	Dec. 11-17	Dec. 18-24	Dec. 25-31
Anthrax	11	8	9	13
Cerebrospinal meningitis	29	18	33	28
Chickenpox	314	402	327	214
Diphtheria	850	801	685	642
Dysentery (amoebic)	9	23	18	6
Dysentery (bacillary)	2	2		2
Hookworm disease	21	7	40	14
Lethargic encephalitis	3		1	1
Measles	920	846	768	592
Mumps	223	203	164	135
Paratyphoid fever	96	80	62	46
Poliomyelitis	37	48	30	36
Puerperal fever	35	26	29	20
Scarlet fever	284	271	244	169
Typhoid fever	389	404	297	280
Undulant fever	31	34	39	28
Whooping cough	263	254	234	184

SWITZERLAND

Communicable diseases—January 1940.—During the month of January 1940, cases of certain communicable diseases were reported in Switzerland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	77	Paratyphoid fever	1
Chickenpox	187	Poliomyelitis	12
Diphtheria and croup	52	Scarlet fever	480
German measles	30	Tuberculosis	200
Influenza	4,692	Typhoid fever	9
Measles	1,574	Undulant fever	1
Mumps	120	Whooping cough	260

YUGOSLAVIA

Notifiable diseases—4 weeks ended February 25, 1940.—During the 4 weeks ended February 25, 1940, certain notifiable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	16	1	Paratyphoid fever	9	1
Cerebrospinal meningitis	415	96	Poliomyelitis	3	1
Diphtheria and croup	546	70	Scarlet fever	250	4
Dysentery	9	1	Sepsis	7	5
Erysipelas	198	9	Tetanus	10	6
Favus	5		Typhoid fever	185	26
Leprosy	1		Typhus fever	68	9
Lethargic encephalitis	2				

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of March 29, 1940, pages 567–571. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Bolivia—Correction.—A correction has been received of a report of 30 cases of plague in Bolivia during the period October 1 to December 31, 1939, which was published in the PUBLIC HEALTH REPORTS of February 23, 1940, page 343. These cases were not plague but influenzal pneumonia.

Smallpox

Japan.—According to a report dated March 27, 1940, the total number of new cases of smallpox in Japan from January 1 to March 25, 1940, was 262, of which 159 cases had occurred since March 15, 1940. For the same period Tokyo reported 17 cases of smallpox and Osaka 29 cases. Compulsory vaccination was being carried out.

Public Health Reports

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IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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TULARAEMIA

(Rabbit Fever)

From the increasing number of human cases and deaths from tularaemia (rabbit fever) occurring each year it is apparent that many who hunt, handle, or consume the flesh of wild rabbits are unaware of the danger to man which may lurk in the small body of this animal. It would be well for the public to note that in 1938 there were in this country 2,088 cases with 139 deaths from this disease. The majority of persons contracting the disease had skinned or otherwise handled wild rabbits. During 1939, 2,200 cases were reported, and it is likely that the complete returns will show that approximately 150 deaths occurred among those cases.

Historically, tularaemia is of great interest to us because our knowledge of the disease is almost wholly the product of American scientific research. The condition, later to be known as tularaemia, was first described in 1910 by Dr. George W. McCoy of the Public Health Service in reporting a "plaguelike" outbreak among ground squirrels in Tulare County, Calif. McCoy and Chapin discovered and described the causative organism in 1912, calling it *Bacterium tularense* after Tulare County, where the disease was first observed. In 1919, Dr. Edward Francis of the Public Health Service, while studying "deer fly fever" in Utah, recognized its identity with McCoy's "plaguelike" disease of rodents and named the infection "tularaemia."

Subsequent research has disclosed the presence of human cases of the disease in 48 States and the District of Columbia and has traced the source of human cases to 24 forms of American wildlife. Since 1925 tularaemia has been recognized for the first time in 10 foreign countries.

WILDLIFE SOURCES OF TULARAEMIA

Wild rabbits and hares are the direct cause of over 90 percent of human cases in the United States. Rabbits raised under domestic conditions, although highly susceptible, have not been found naturally

infected, probably owing to their freedom from ticks. Market men, hunters, housewives, and others who dress rabbits with bare hands may become infected.

Horseflies have caused 68 cases in Utah and surrounding States. They bite on the exposed parts of the body. Thirty of 170 enrollees in a Civilian Conservation Corps camp in Utah became infected in July 1935. Their unusual sites of infection were located on the back, since the boys, when at work, were stripped to the waist.

Wood ticks have caused 53 cases in Montana and surrounding States. The dog tick has caused 73 cases, principally in the southern States. Ticks bite under the clothing or hidden in the hair.

Sheep contact has caused 12 cases in the Northwest among shearers, butchers, and herders, the infection entering the hands from contact with wood ticks and tick feces located in the wool. Sheep are only very slightly susceptible.

Insect bites (species undetermined) caused 9 cases. One infected person had picked ticks from a dog and crushed them with his fingers.

Tree squirrels had been dressed by 14 patients. Nine had killed and skinned opossums. One case each followed the skinning or dressing of a sage hen, coyote, deer, red fox, or bull snake. Two cases each followed like contact with quail, ground hog, muskrat, hog, or skunk. Two had been scratched by cats and 11 were bitten by cats. Single cases have resulted from bites of raccoon, skunk, coyote, tree squirrel, Montana ground squirrel, opossum, dog, hog, lamb, and a white rat; here contamination of the animal's mouth parts is assumed. The dissection of infected laboratory animals has caused 56 cases in laboratory workers.

Eating insufficiently cooked wild-rabbit meat caused 20 cases in 5 families in the United States, of whom 12 died.

A water-borne epidemic of 43 cases was reported in 1935 from Russia in peasants who drank water from a brook which was thought to have been contaminated by water rats. Early in 1940, officers of the Public Health Service reported that water in 3 streams in Montana had been found to be contaminated with *Bacterium tularense*. This discovery was incidental to studies of an outbreak of tularaemia in beaver.

EFFECT OF THE ORGANISM ON WILD RABBITS

The disease in wild rabbits causes the liver and spleen to become covered with small spots which may be seen when the carcass is being dressed. The germs invade and multiply in every tissue in the animal's body, including blood and muscles, ultimately causing its death. Ordinarily, only about 1 in every 100 rabbits in the wild state is infected, but occasionally the disease becomes epidemic among them and then it is not uncommon to find dead rabbits lying about in their natural habitats.

MECHANISM OF HUMAN INFECTION

The organism may be transmitted from one animal to another and from animal to man by the bite of insects, notably the wood tick, the dog tick, and the deer fly.

The majority of human infections are contracted as the result of the organism entering through a skin wound, inflicted at the time of infection or shortly before or shortly after the germs get on the skin. Infection may be caused by pricking the skin with a fragment of rabbit bone broken by a shot, by a cut from a skinning knife, or if animal blood or body secretions get into the smallest skin abrasion. Sometimes the infection penetrates the apparently unbroken skin of the hands but usually there is a minute cut or scratch through which the germs enter the body. Fingers soiled by rabbit blood may convey the infection to the eyes. Several serious outbreaks of tularaemia have been attributed to eating insufficiently cooked rabbit meat. The fact must not be lost sight of that the pelts of infected rabbits and other animals may also convey the infection.

SYMPTOMS OF TULARAEMIA IN MAN

On an average of about 3½ days after exposure illness begins suddenly with headache, chilliness, vomiting, fever, prostration, and aching pains all over the body. The symptoms are often mistaken for those of influenza. The sore, usually on the hand, develops into an ulcer, and the nearby lymph glands, at the elbow or in the armpit, become enlarged, tender, and painful, and later may develop into abscesses. Illness and fever last for about 3 weeks. Convalescence is slow and is characterized by great weakness and disability which may continue for 2 or 3 months. Most patients recover without permanent ill effects, but about 5 percent die, notably among those who develop pneumonia. One attack of the disease confers immunity.

PREVENTION OF INFECTION

Hunters, vacationists, butchers, housewives, and laboratory workers who handle rabbits and other wild game are especially exposed to tularaemia.

A wild rabbit should never be handled with the bare hands. Rubber gloves, so long as they are impervious, afford excellent protection, but they are easily pierced by skinning knife or by fragments of bone and the wearer must be alert to avoid even the most inconspicuous skin prick.

Immune persons only should be employed in laboratories working with known or presumably infected animal and insect hosts of the disease.

The liberal use of soap and water, followed by disinfection, is recommended to remove blood or other infected material from the hands. The same precaution should be observed after touching the fur of wild rabbits or other game killed in areas where tularaemia is known to exist.

Infected meat is rendered safe for food by thorough cooking, but the organism will remain alive and virulent in the red juices of partly cooked game.

Refrigeration for ordinary periods does not kill the organism causing tularaemia.

There is no specific preventive or curative treatment for the disease.

CONTROL LEGISLATION

Legislation designed to prevent the spread of tularaemia, by restricting the purchase and sale or handling of wild hares and rabbits, has been enacted in at least three States—Connecticut, New Hampshire, and Ohio.

EFFECT OF PETROLEUM ETHER EXTRACT OF MOUSE CARCASSES ON SKIN TUMOR PRODUCTION IN C57 BLACK MICE [1]

By John J. Morton, *Professor of Surgery, University of Rochester*, and G. Burroughs Mider, *Research Fellow, National Cancer Institute, United States Public Health Service*

Lipoids have been implicated frequently in the genesis of mouse skin tumors. Roffo (*1*) ascribed a major role in the production of epidermoid neoplasms to cholesterol. Watson and Mellanby (*2*) found that a petroleum ether extract of normal mouse tissues enhanced the carcinogenic action of tar when applied at the site of tarring. Several carcinogenic agents have been found to be more effective in producing skin tumors when the test animals received a high fat diet (*3*, *4*, *5*).

The approach to the problem has been largely empirical, utilizing readily available materials. The experiments to be reported deal with substances extractable from mice which influence the production of skin tumors by a carcinogenic hydrocarbon. Those substances responsible for the results obtained may be capable of ultimate identification. The data have been analyzed by standard statistical methods.

[1] From the Department of Surgery, University of Rochester School of Medicine and Dentistry, Rochester, N. Y. This investigation was aided by grants from the International Cancer Research Foundation and Mr. Simon Stein.

MATERIAL AND METHOD

C57 black mice have been used throughout these experiments. They are a closely inbred strain, developed at the Roscoe B. Jackson Memorial Laboratory, and have a relatively low incidence of spontaneous neoplasms (*6*). Spontaneous skin tumors are almost unknown in mice less than 1 year old. The animals were approximately 6 weeks old when painting was commenced. Sex distribution was equal within each group but breeding was prevented. The mice were kept in glass cages. They were fed a diet of Purina dog chow, water being available at all times.

Extracts were prepared from normal adult mice. Fresh minced mouse carcasses, from which the stomach and intestines had been excised, were refluxed with petroleum ether (maximum boiling point 50° C.) for 16 hours. The petroleum ether was removed by distillation under reduced pressure. This procedure gave a poor yield of extract.

A better yield was obtained by refluxing minced mouse carcasses with ethyl alcohol for 5 hours, the extractive being changed at hourly intervals. The filtered solution was concentrated by low pressure distillation. Two volumes of water were added to the residue and the mixture was shaken with petroleum ether.

The extracts prepared by both methods were yellow, turbid, oily, and had a characteristic odor. A grey-white, amorphous, greasy substance settled out on standing. The supernatant liquid was yellow and clear.

3:4-Benzpyrene[2] 0.5 percent in benzene was used as the carcinogenic agent. It was applied to the unepilated skin of the interscapular region twice weekly with a No. 6 camel's hair brush. Painting was continued for 14 weeks.

Control groups were painted with benzpyrene solution only. The mice that received extract were painted twice with benzpyrene. Thereafter the petroleum ether extract was applied to the same area with a No. 6 camel's hair brush 20 to 30 minutes before painting with the carcinogen. Each experimental mouse received a total of 28 paintings with 3:4-benzpyrene 0.5 percent in benzene and 26 with the extract during the 14-week period. The mice were then observed for 67 days (one hundred sixty-fifth day of experiment) when all survivors were sacrificed. Previous observations showed that the first skin cancer in C57 black mice painted twice weekly with 3:4-benzpyrene 0.5 percent in benzene usually arose during the fourteenth week of painting. This determined the duration of the painting period. The experiment was terminated at 165 days because a sharp rise in mortality occurred then.

[2] Obtained from Hoffman-LaRoche, Nutley, N. J., and used without further purification.

Each tumor was individually identified and its life history was recorded. A diagnosis of carcinomatous change in a papilloma was made by alteration in the growth rate, by ulceration, and, most important, by induration at the base. No biopsies were performed but all cancers and suspicious lesions were examined histologically when the animal died. Invasion of muscle was taken as the microscopic criterion of malignancy. The histologic and clinical diagnoses usually agreed. All previous diagnoses of malignancy were confirmed. Some suspicious lesions, classified as papillomata in the living mouse, showed unmistakable heterotopia on section. The error occasioned by this discrepancy was minimal.

The number of mice that were living when the first papilloma appeared was designated as the effective total. This figure was the basis for all computations respecting papillomata. The effective total for mice with carcinomata was determined in the same manner. All mice living when the first tumor appeared were considered capable of forming a tumor. Subsequent death of a mouse without tumor formation tended to dilute the statistics. Mortality was parallel in control and experimental groups.

The mean number of papillomata per mouse was obtained by dividing the total number of papillomata by the effective total. This value was affected adversely when tumor incidence was low. The presence of mice without tumor caused a wider variation. Larger differences between control and experimental groups were necessary to establish statistical significance.

The latent interval to the first papilloma and first carcinoma in each mouse was determined. The average of these values was designated the mean latent interval for papilloma and carcinoma for the group. The mean transition time was computed from the life histories of the individual tumors. One of us made all observations on the living animals, thus reducing individual variation.

RESULTS

The results of painting C57 black mice with benzpyrene 0.5 percent in benzene alone and of painting with petroleum ether extract of mouse carcasses prior to the application of the carcinogen are presented in table 1. Little variation exists among groups treated similarly at different times. Groups A and D and groups C and E were painted concurrently. Mortality was almost identical. Therefore, direct comparison of the totals for all mice treated in control and experimental groups is justified.

TABLE 1.—*The effect of petroleum ether extract of mouse carcasses on the production of skin tumors in C57 black mice painted with 3:4-benzpyrene 0.5 percent in benzene*

Factor	Benzpyrene only				Extract and benzpyrene		
	Group A	Group B	Group C	Total	Group D	Group E	Total
Papillomata							
Effective total	50	48	50	148	49	49	98
Number of mice with papillomata	37	39	35	111	46	43	89
Percent of mice with papillomata	74	81.2	78	77.7	94	88	90 8
Total number of papillomata	99	105	99	303	201	173	374
Mean number papillomata per mouse	1.98±0.27	2.18±0.26	1.98±0.28	2.05±0.27	4.02±0.36	3.53±0.27	3.78±0.32
Coefficient of variation	0.976	0.825	0.723	0.834	0 626	0 501	0 563
Mean latent period (days)	92.0±3 4	80.8±4.7	92.2±3.9	88.3±4 0	85.7±2 9	89 5±2.9	87.6±2 9
Coefficient of variation	0.367	0.352	0.257	0.315	0.324	0.241	0.235
Mean transition time to carcinoma (days)	44.4	50.9	46.6	47.3	42.6	35.6	39.1
Carcinomata							
Effective total	49	46	42	137	48	42	90
Number of mice with carcinoma	16	18	24	58	25	32	57
Percent of mice with carcinoma	32.6	39.1	57.1	42.3	52 1	76.2	63.3
Total number of carcinomata	16	20	25	61	27	35	62
Mean latent period (days)	138 0	134.8	147.1	139.8	135.6	128.6	132.1
Percent of papillomata that became malignant	16.1	19.0	25.1	20.1	13.4	20.2	16.5

More of the mice that were painted with extract and benzpyrene had papillomata than did those that were painted with benzpyrene only. The extract group also had a larger number of papillomata. The difference in each case is more than three times the standard error of the difference, and thus unlikely to be a chance phenomenon (7). The same observations apply to carcinomata. Again the differences are statistically significant.

The temporal factors show little variation. Petroleum ether extract of mouse carcasses did not accelerate the production of the first papilloma in each mouse. The appearance of carcinomata in the mice of the experimental group was earlier and the time of transition from papilloma to carcinoma was shorter when the mice had been treated with extracts. Although these small differences fall within the limits of probable error, a definite, constant trend toward earlier cancer in the extract-painted group is suggestive. Subsequent experimentation may show it to be significant.

Further evidence shows that the fundamental biology of the papilloma *per se* is not altered. One might expect a difference in the incidence of papillomata that subsequently became malignant with respect to the time at which they arose. If the proportion of carcinomata that arose from the first papilloma in each mouse is computed, it is found to be almost identical for the two groups (table 2). The second, third, and subsequent papillomata show considerable variation. If these are grouped together, however, the incidence of carcinomata arising from the papillomata is the same. The total incidence of

carcinomata arising from papillomata in control and experimental groups is 20.1 percent and 16.5 percent, respectively. The difference between the two proportions falls within the limits of experimental error.

TABLE 2.—*Incidence of carcinomata arising from papillomata with reference to sequence of appearance of papillomata*

Factor	Benzpyrene only				Extract and benzpyrene		
	Group A	Group B	Group C	Total	Group D	Group E	Total
Total number first papillomata	37	39	39	115	46	43	89
Number of carcinomata	11	13	17	41	15	16	31
Percent of carcinomata	30.0	23.3	43.5	35.6	32.6	38.1	34.8
Total number second papillomata	23	23	29	75	41	35	76
Number of carcinomata	0	5	6	11	8	10	18
Percent of carcinomata	0	21.7	20.6	14.6	19.5	28.5	23.6
Total number third papillomata	16	19	16	51	34	32	66
Number of carcinomata	2	2	3	7	2	4	6
Percent of carcinomata	12.5	10.5	18.8	13.7	5.8	12.5	9.1
Total number fourth papillomata	10	12	11	33	28	26	54
Number of carcinomata	0	0	0	0	4	1	5
Percent of carcinomata	0	0	0	0	14.3	3.9	9.2

The part played by the extract in the increase in tumor production is not clear. Baumann, Jacobi, and Rusch (*5*) noted that "animals on a high fat diet became greasy in appearance," suggesting that the action of the ration might have exerted itself locally. A group of 50 C57 black mice was injected twice weekly with 0.05 cc. of petroleum ether extract of mouse carcasses in the subcutaneous tissue of the inguinal region. This was continued for 14 weeks. The mice were painted in the interscapular region with 3:4-benzpyrene 0.5 percent in benzene 20 to 30 minutes after each injection. A second group of mice was treated in the same manner except that sesame oil (technical grade) was substituted for the extract. Another group received local applications of benzpyrene only (group B, table 1). The appearance of the coat was not changed. The results of the experiment are presented in table 3. No significant difference in production of benign or malignant skin tumors was found. The effect of larger subcutaneous doses of extract will be investigated.

Crystalline benzpyrene is soluble in petroleum ether extract of mouse carcasses to at least 0.5 percent. The oily nature of the extract might cause it to be absorbed slowly and leave enough on the skin to dissolve the benzpyrene in benzene that was applied later, and a prolonged action of benzpyrene on the skin might be obtained. Previous experience showed that benzpyrene dissolved in similarly prepared extract was not effective in the production of sarcomata when injected subcutaneously in C57 black mice (*8*).

TABLE 3.—*The effect of injection of sesame oil and petroleum ether extract of mouse carcasses on the production of skin tumors by 3:4-benzpyrene in C57 black mice*

Factor	Sesame oil	Extract
Papillomata		
Effective total	49	49
Total number of mice with papillomata	40	44
Percent of mice with papillomata	82.6	89 8
Total number of papillomata	135	142
Mean number per mouse	3.37±0 42	3.21±0 42
Coefficient of variation	0.623	0.685
Mean latent period (days)	83.1±3 4	78.7±3 9
Coefficient of variation	0.256	0.327
Mean transition time to carcinoma (days)	45	40
Carcinomata		
Effective total	47	47
Total number of mice with carcinoma	20	25
Percent of mice with carcinoma	42.5	53 2
Total number of carcinomata	23	29
Mean latent period (days)	138.7±4.5	124.1±4.2
Percent of papillomata that became malignant	17.2	20.4

The results of painting mice with benzpyrene 0.5 percent in mouse extract are shown in table 4. The marked decrease in tumor production suggests an entirely different action from that anticipated. The difference may be due either to physical or chemical phenomena. An attempt was made to isolate benzpyrene from the extract solution by the method of Berenblum and Kendal (*9*). The substance obtained gave an ultraviolet absorption spectrum identical with that of 3:4-benzpyrene. This suggests that solution of the benzpyrene in the extract that has been previously painted on the skin does not increase tumor production.

TABLE 4.—*The effect of painting C57 black mice with 3:4-benzpyrene 0.5 percent in petroleum ether extract of mouse carcasses on the production of skin tumors*

Factor	Benzpyrene in benzene	Benzpyrene in extract
Papillomata		
Effective total	50	47
Number of mice with papillomata	35	29
Percent of mice with papillomata	70	61.7
Total number of papillomata	99	48
Mean number per mouse	1.98±0 28	1.02±0.9
Coefficient of variation	0.723	0.647
Mean latent period (days)	92.2±3.9	101.4±5.0
Coefficient of variation	0.257	0.252
Mean transition time to carcinoma	46.6±5.3	37.0±4.1
Carcinomata		
Effective total	45	47
Number of mice with carcinoma	24	18
Percent of mice with carcinoma	53.3	38.2
Total number of carcinomata	25	20
Mean latent period (days)	147.1	146.1
Percent of papillomata that became malignant	25.7	41.6

SUMMARY

A petroleum ether extract of mouse carcasses increased the number of skin tumors produced by 3:4-benzpyrene when painted on the skin 20 to 30 minutes before the carcinogen was applied to the

same area. The increase in carcinomata paralleled the increase in papillomata.

Subcutaneous injection of extract at a distance from the site of application of benzpyrene did not affect tumor production.

A solution of benzpyrene in petroleum ether extract of mouse carcasses produced fewer skin tumors than did benzpyrene in benzene.

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BACTERIUM TULARENSE: ITS PERSISTENCE IN THE TISSUES OF THE ARGASID TICKS *ORNITHODOROS TURICATA* AND *O. PARKERI* [1]

By Gordon E. Davis, *Bacteriologist, United States Public Health Service*

In a study of ticks of the genus *Ornithodoros* as potential vectors of various infectious agents, it has been found that viable *Bact. tularense* may persist in the tissues of *O. turicata* for at least 674 days and in those of *O. parkeri* for at least 701 days following an infective blood meal, but that these ticks do not transmit the organism during the process of feeding.

The ticks used in this study ingested blood from guinea pigs ill with tularaemia. They were subsequently tested at irregular intervals for transmission of *Bact. tularense* and for the persistence of this organism in the tissues. The former tests were made by permitting individual ticks to feed to repletion on test guinea pigs and to detach voluntarily; the latter were made by injecting saline suspensions of tick tissues subcutaneously.

The clinical symptoms and the specificity of gross lesions in the test guinea pigs were confirmed by the recovery of pure cultures of *Bact. tularense* which were agglutinated by specific rabbit serum.

[1] From the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

O. turicata

Infective feedings.—On May 7, June 13, and June 19, 1937, 22, 7, and 20 ticks, respectively, in various developmental stages, engorged on infected guinea pigs.

Test feedings on guinea pigs.—In the group of 22 ticks there were 37 test feedings; in the group of 7 there were 17, and in the group of 20 there were 52. The earliest and latest test feedings (of ticks which proved positive when injected) were made 28 and 618 days, respectively, after the infective feeding. In no instance did the host guinea pig show any evidence of tularaemia.

Tests by injecting a saline suspension of tick tissues into guinea pigs.—Twelve ticks died and were not injected. One guinea pig died on the second day after tick-injection showing no evidence of tularaemia. The results of injection of the remaining 36 ticks are shown in table 1. The tick number, the number of days after the infective feeding, the total number of feedings, and the stage or sex of the tick when injected are shown.

TABLE 1.—*The persistence of Bact. tularense in the tissues of O. turicata*

Tick number	Injected, days after infective feeding	Injected, days after last feeding	Total test feedings	Stage or sex
Positive tests:				
1	0	0	0	Nymph.
30	0	0	0	Do.
2	10	10	0	Do.
3	22	22	0	Do.
4	40	12	1	Do.
8	60	60	0	Do.
7	96	96	0	Do.
48	104	48	1	Male.
5	117	19	2	Do.
14	158	56	1	Do.
47	198	73	2	Do.
40	263	140	2	Nymph.
18	276	27	1	Male.
26	412	143	4	Female.
33	507	449	1	Male.
11	647	45	4	Female.
41	667	49	5	Do.
35	674	56	5	Do.
Total			29	18
Negative tests:				
21	143	45	1	Male.
34	303	178	2	Do
43	311	167	2	Nymph.
32	465	338	2	Do.
23	482	351	2	Female.
45	490	298	3	Do.
29	507	385	2	Nymph.
16	526	336	2	Male.
49	564	439	2	Do.
28	578	421	2	Nymph.
25	583	518	1	Male.
46	584	25	2	Female.
39	587	443	2	Male.
27	588	456	1	Do.
42	608	88	2	Female.
6	634	21	5	Do.
38	664	94	4	Do.
22	703	42	5	Do.
Total			42	18

Eighteen ticks (8 nymphs, 6 males, and 4 females), 50 percent of the ticks injected, produced typical tularaemia in guinea pigs. Ten of these were from group 1 (71 percent), 1 from group 2 (16⅔ percent), and 7 from group 3 (43 percent). The small percentage of infections recovered from group 2 might indicate a low original tick infection rate. However, the ticks of this group were injected relatively late in the experiment, viz, 412, 482, 507, 578, 583, and 508 days, respectively, following the infective feeding. Only the 412-day tick produced infection. In group 1, which had the highest percentage of positives, ticks injected 0, 10, 22, 40, 60, 96, 117, 158, 276, and 647 days, respectively, following the infective feeding each produced typical tularaemia, while ticks injected after 143, 526, 634, and 703 days, respectively, gave negative results. In group 3, ticks injected 0, 104, 198, 263, 507, 667, and 674 days, respectively, following the infective feeding were positive and those injected 303, 311, 465, 490, 564, 584, 587, 608, and 664 days, respectively, failed to produce the infection.

Attempts to recover Bact. tularense from progeny of female ticks (*table 2*).—These tests are divisible into 3 groups, viz, progeny from females that died and were not injected, from females "negative" when injected, and from females "positive" when injected. In the first group 526 larvae were tested by feeding and 454 by injection, 72 nymphs by feeding and 3 by injection, and 16 adults by both feeding and injection. In the second group 443 larvae were tested by feeding, 276 by injection, 166 nymphs by feeding, 4 by injection, and 26 adults by both feeding and injection. In the third group 183 larvae were tested by feeding, 106 by injection, 66 nymphs by feeding, and 14 by injection. None of the test guinea pigs showed evidence of infection.

TABLE 2.—*Tests of progeny of O. turicata that ingested infective blood*

Number of females	Larvae		Nymphs, first to fifth stages		Adults	
	Fed	Injected	Fed	Injected	Fed	Injected
	PROGENY TESTED FROM FEMALES THAT DIED AND WERE NOT INJECTED					
6	526	454	72	3	16	16
	PROGENY TESTED FROM FEMALES "NEGATIVE" WHEN INJECTED					
5	443	276	166	4	26	26
	PROGENY TESTED FROM FEMALES "POSITIVE" WHEN INJECTED					
4	183	106	66	14		

NOTE.—None of the above progeny produced tularaemia by feeding or injection.

O. parkeri

Infective feedings.—On June 18, 1937, 4 late nymphs and on October 21, 1937, 21 first stage nymphs engorged on a guinea pig infected with *Bact. tularense.*

TABLE 3.—*The persistence of Bact. tularense in the tissues of O. parkeri*

Tick number	Injected, days after infective feeding	Injected, days after last feeding	Total test feedings	Stage or sex
Group 1:				
1	57	57	0	Nymph.
2	81	81	0	Do.
3	131	131	0	Do.
4	412	412	0	Do.
Group 2:				
7	138	46	2	Male
17	339	54	2	Female.[1]
20	355	69	4	Do.
23	440	156	4	Do.
2	470	303	4	Do.
4	496	328	4	Do.
11	529	77	4	Do.
14	576	67	5	Do.
21	606	97	4	Do.
15	667	158	5	Do.
25	701	191	4	Do.
8	died		5	Do.
12	died		4	Do.
Total			52	

[1] With the exception of this female, all ticks produced typical tularaemia when injected.

Tests by feeding on guinea pigs.—In the first group there were no test feedings. In the second group a total of 52 such feedings failed to infect the host guinea pigs. Forty-one of these were by ticks which proved infective when injected. The earliest and latest test feedings (of ticks which proved positive when injected) were made 28 and 509 days, respectively, after the infective feedings.

Tests by injecting a saline suspension of tick tissues into guinea pigs.—Each of the first 4 ticks produced typical tularaemia when injected 57, 81, 131, and 412 days, respectively, following the infective feeding. Only 11 of the second group survived for injection. Ten of these were males and 1 a female. The latter failed to infect when injected 339 days following the infective feeding. The 10 males produced typical infections when injected at 138, 355, 440, 470, 496, 529, 576, 606, 667, and 701 days, respectively.

DISCUSSION

The residence of *Bact. tularense* in the two species of ticks does not adversely affect the virulence of the organism. Of the 18 guinea pigs that died of tularaemia following injection of infected *turicata,* 3 died on the second day, 6 on the third, 7 on the fourth, and 2 on the sixth day. The last 2 were 263- and 412-day ticks. The 674-day tick produced death in 2 days.

It is also shown that starvation of the tick does not affect the virulence of the organism. Although the 507-day tick had not received a blood meal for 449 days previous to injection, it produced death on the third day. The guinea pig which received the 412-day infected *parkeri* died on the third day. This tick had not fed during the 412-day period. The guinea pig which received the 701-day tick died on the fourth day. This tick had not fed for 190 days.

Kamil and Bilal (*1*), working in Turkey, have reported the transmission of *Bact. tularense* by *O. lahorensis.*

CONCLUSIONS

1. *Bact. tularense* may survive for at least 674 and 701 days, respectively, in the tissues of *Ornithodoros turicata* and *O. parkeri*, but is not transmitted during feeding.
2. The virulence of the organism was not adversely affected by the long period of residence in these ticks nor by the failure of the ticks to receive a blood meal.

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TICKS (*ORNITHODOROS* SPP.) IN ARIZONA BAT "CAVES"[1]

By Cornelius B. Philip, *Medical Entomologist, United States Public Health Service*

Incident to studies of *Ornithodoros* ticks and relapsing fever being carried on by the Rocky Mountain Laboratory, several observations on ticks of this genus in association with bats were made in late September 1939, in Arizona. Of principal interest was the finding for the first time, under natural habitat conditions, of the recently described bat-guano tick, *O. coprophilus* McIntosh (1935). This tick previously had been collected only at Tucson, Ariz., from guano sold locally, and at Matamoros, Mexico, from bat fertilizer intended for importation at Brownsville, Tex.

Of the various types of roosts used by bats, mine tunnels with their easily reached ceilings and less irregular walls offered the most advantageous conditions for sampling both roosting bats and guano. (See also Stager, 1939.) Collections were made in four such tunnels. Males of the desert pallid bat, *Antrozous pallidus pallidus*, were obtained in one in the Santa Rita Mountains (September 21), and

[1] Contribution from the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health Read before the Columbus, Ohio, meeting of the American Society of Parasitologists, December 28, 1939.

females in one near Arivaca (September 22); a few of unrecorded sex were found in another in Picacho Mountain (September 24). A few *Myotis velifer velifer*, the cave bat, were found in a tunnel near Ruby and males were also present by the hundreds in the Picacho "cave." In the latter, both sexes of the Mexican free-tail, *Tadarida mexicana*, were present in immense numbers, and occasional specimens, predominantly males, of *Macrotus californicus*, a leaf-nose species.

Fifteen and 12 *A. pallidus*, respectively, taken in the Santa Rita and Arivaca caves, were infested by *talaje*-like larvae which have not yet been identified, but which are definitely not *O. coprophilus*. Most of these bats were infested by one or more ticks, and one from the Arivaca tunnel yielded 17 in various stages of engorgement. Only the nearly engorged larvae voluntarily detached from killed and bagged animals; the partially fed ticks had to be removed by excising the portions of the skin to which they were attached. Three more larvae, apparently of the same species, were taken from 2 of 45 bats collected in the Picacho "cave." Developmental studies of these specimens are being made by Dr. R. A. Cooley and Glen M. Kohls.

The Arivaca and Picacho "caves" were the only ones visited which were inhabited by sufficient numbers of bats to provide an appreciable accumulation of guano on the tunnel floors. No *O. coprophilus* were found in guano from the first, although the far end was not examined. This may have been an oversight in view of the Picacho experience recounted below.

The Picacho "cave" was a mine tunnel driven 310 feet into solid rock 5 years previously. The ceiling was only 6½ to 7 feet high and could easily be studied by flashlight. Guano was continuous over the floor, starting about 20 feet from the entrance, and samples taken up to approximately 260 feet inside revealed only tremendous numbers of dermestid beetles and pseudoscorpions. In the last 50 feet, however, the guano was found infested with *coprophilus* in increasing numbers and in the last 25 feet flashlight examination showed thousands of ticks crawling sluggishly over the surface. None was found below the surface or higher than 2 to 3 inches above it on the walls. A bagged sample of guano from an estimated surface area of one square foot and approximately 2 inches deep taken from near the end of the tunnel was found to contain 301 ticks in all stages from young nymphs to adults. The guano here was moist and sticky, its temperature being 81° F., identical with that of the air at arm's height. A sling psychrometer showed the relative humidity to be between 91 and 92 percent in this part of the tunnel. A very foul atmosphere, strongly ammoniated, discouraged prolonged observation.

Bats were hanging on the ceiling in countless numbers almost the full length of the tunnel. After those above the tick-infested guano were dislodged, no ticks could be found on the ceiling or upper walls. There were very few crevices and fissures in which they could have escaped notice. No *coprophilus* were found on 18 bats picked off the ceiling over the ticks, nor on 27 others taken on the wing, and none of the specimens of the various stages of this tick collected on the guano showed evidence of blood meals. Two dozen, representing the several stages present, were immediately placed in alcohol for later dissection. These also furnished no evidence of recent feeding.

Not knowing the parasitic proclivities of this species, but recalling the habits of other *Ornithodoros*, such as *turicata* in Texas caves, the writer was concerned about standing and walking in the midst of so tremendous a population of ticks, but at no time did any ticks attempt to crawl on to his shoes, and when placed thereon consistently crawled off. Later, on request, the owner of the property, Mr. L. O. Brown, confined live bats and fresh ticks of all stages in bags for several days, but when received at Hamilton none of the ticks showed evidence of having fed. Mr. Brown, using a mask to facilitate longer observation, observed ticks higher on the walls than any noted by the writer, but still found none on the bats or on the ceiling near them. In spite of present lack of evidence of tick parasitism of the bats, there was no evidence of use of the "cave" by other possible hosts.

In further guano samples forwarded by Mr. Brown, there were, in addition to very numerous *O. coprophilus*, 25 nymphs and 3 adults of a species obviously not *coprophilus* and also not of the same species as the larvae collected from bats. This will be described as a new species by Dr. Cooley and Mr. Kohls.

As thus far observed, it appears rather unlikely that *O. coprophilus* is an agent of disease transmission to man, or that its distribution with commercial bat fertilizer is potentially dangerous. However, its host habits and developmental requirements remain speculative. It is possible that, if *coprophilus* does parasitize bats, the relationship may be seasonal.

ACKNOWLEDGMENT

Special thanks are due Mr. L. O. Brown, owner of the Picacho property, for his cooperation and generous assistance in gathering materials, and to Dr. E. Raymond Hall and Mr. R. A. Flock who identified the bats.

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STUDIES ON TRICHINOSIS

VIII. THE ANTIGENIC PHASE OF TRICHINOSIS [1]

By JOHN BOZICEVICH, *Associate Zoologist*, and LASZLO DETRE,[2] *Senior Immunologist, National Institute of Health, United States Public Health Service*

This study evolved from the attempts of the writers to develop a test which could be used in diagnosing trichinosis at an earlier stage of the disease than has been possible heretofore. Serum from rabbits which had been fed trichinae 24 hours previously was injected into the skin of trichina-infected rats, the serum of which was known to contain precipitins. A wheal occurred at the site of injection, suggesting the presence of antigen in the rabbit serum since the type of reaction was unlike that given by the serum of noninfected rabbits. Further tests to determine the presence of antigen in rabbits recently infected with trichinae were made by injecting the serum of these rabbits into noninfected rabbits at a stage prior to the development of precipitins in the infected rabbits. It was found that precipitins developed in the rabbits which received the transferred serum; that these precipitins could be detected at an earlier stage than in those rabbits which received the trichinae; and that the period between the infection of rabbits in the primary group and the appearance of precipitins in rabbits of the secondary group was relatively constant. This phenomenon is not dependent upon the passive transfer of precipitins, since precipitins were not demonstrable in the blood serum of infected rabbits at the time of the transfer.

While a few previous investigators have made analogous observations in connection with other antigens and antibodies, their experiments have been either inconclusive or have resulted in contradictory findings.

Thus Detre [i. e., Deutsch] (*1*) inoculated killed typhoid bacilli into guinea pigs and transferred their serum to noninfected guinea pigs. Eight days after injection agglutinins appeared in the blood of the latter animals in a titer as high as 1:300.

Luckhardt and Becht (*2*) inoculated dogs with the emulsified spleen of other dogs which had been injected 24 hours previously either with goat corpuscles or with typhoid bacilli, and subsequently demonstrated corresponding antibodies in the recipients. However, with defibrinated blood, they could not demonstrate an increase in the agglutinin titer in the secondary animals.

Scarff (*3*), employing sheep cells and typhoid organisms as antigens, obtained results similar to those of Luckhardt and Becht.

[1] From the Division of Zoology and the Division of Infectious Diseases.
[2] Died May 26, 1939.

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Rosenthal (*4*) injected colloidal phenolphthalein into guinea pigs and collected the blood from these animals 1½ hours later. This was inoculated into other guinea pigs. He found that some of the latter animals became sensitized to the colloidal phenolphthalein.

Manwaring, Marino, McCleave, and Boone (*5*) found that the blood from dogs which had received horse serum 4 days previously was capable of inducing anaphylactic shock in hypersensitive dogs. These authors showed that the antigenic property was not lost after a sojourn of 4 days in the circulation of the injected animals. However, in contradiction to these results, Hektoen and Carlson (*6*) concluded that antigens are quickly removed from the blood and the antigenic property lost. Topley (*7*) obtained indifferent results in this connection.

EXPERIMENTAL PROCEDURE

All experimental animals were checked for the possible presence of precipitins to trichina antigen before being placed in the experiments; however, none gave positive tests.

Several series of rabbits were infected with living trichina larvae, and, successively at daily intervals after infection, one of these animals, hereinafter called "donors," was bled from the heart and its serum injected intravenously into a noninfected rabbit, the noninfected rabbits hereinafter being called the "recipients."

For convenience, the time elapsing between infection and drawing of the blood from the donors will be called the first incubation period or the "antigenic phase." The time elapsing from the injection of the recipient animal with the serum from the donor to the appearance of demonstrable precipitins in the serum of the recipient will be called the second incubation period. An example of the procedure is as follows· Donor rabbit No. 3 (table 1) was given by stomach tube 6,600 larvae, or 3,000 larvae per kilogram of body weight. Twenty-four hours later, in order to obtain blood for the precipitin test, the animal was bled from the ear previous to anesthetization, since it was found that the serum became cloudy when etherization was employed. After the blood had been taken from the ear, the animal was immediately anesthetized and 50 to 80 cc. of blood drawn and distributed in large centrifuge tubes. The blood was allowed to stand until the clot retracted and was then centrifuged. The serum was decanted and examined under the microscope for the possible presence of migrating trichina larvae. Passive transfer of trichina larvae does not occur before the ninety-sixth hour after infection; however, after this period particular attention should be given to the serum in order to prevent the transfer of larvae. In these experiments larvae have never been found in the serum obtained after

clotting, but they have been observed enmeshed in the clot from blood drawn after the one hundred and twentieth hour.

Within 3 hours after drawing the blood from the donor, recipient rabbit No. 3A was injected intravenously with 10 cc. per kilogram of body weight of serum from donor No. 3. The total quantity of serum injected was 21.9 cc. Recipient No. 3A was bled from the ear daily thereafter and precipitin tests were performed on the serum. A positive precipitin reaction was obtained on the sixteenth day after this animal had received the serum injection, or 17 days after the date of infection of the donor animal. The length of the first incubation period, or the antigenic phase, was 1 day, and that of the second incubation period was 16 days.

Our experience is in agreement with that of Trawinski and Maternowska (*8*), who found that precipitins can usually be demonstrated in trichina-infected animals on and after the fourteenth day following infection. However, precipitins develop earlier at times, and it is therefore necessary to make daily tests on the infected or donor animals in order to avoid the actual transfer of precipitins to recipient animals.

METHOD OF PERFORMING PRECIPITIN TESTS

By means of a capillary pipette, 0.05 cc. of undiluted serum is placed carefully in the bottom of a 2 x 60 mm. tube. The tubes are centrifuged immediately in order to insure that the walls are free from serum. This precaution is important in order to obtain an accurate reading with the stratification method. Trichina antigen prepared according to the method of Bozicevich (*9*) in progressive dilutions of 1:20 to 1:320 is stratified in 0.05 cc. volumes over the centrifuged undiluted serum. Two controls are employed, one in which physiological saline is stratified over the experimental rabbit serum, and the other in which human serum in progressive dilution of 1:20 to 1:320 is stratified over the rabbit serum.

The tubes are read for the appearance of a precipitin ring at the end of 15 minutes, 30 minutes, 1 hour, and 2 hours. When the serum of anesthetized animals is injected into recipient animals, a pseudo-precipitin ring is often obtained 24 hours after injection. In such instances the serum should be diluted 1 to 1 and the test repeated. The use of diluted serum obviates the appearance of the pseudo-reaction. These pseudo-reactions are occasionally encountered in the early stages of natural infections with trichinae, and serum from such cases contains relatively large quantities of lipoid-like substances which render difficult the reading of the reaction. At times a double ring formation is seen. According to Schaefer (*10*) this is dependent upon the relative concentrations of the antigen

and antibody. Thus, the ring forms in the serum if the antigen is in excess, and in the antigen when the antibody is in excess.

EXPERIMENTAL RESULTS

Fifty-three recipient rabbits were used in our experiments. One of these died, 2 failed to develop precipitins, and 3 showed evidence of a passive transfer of precipitins. These 6 animals were discarded. Since the donor's serum was transferred to recipients within 3 hours after bleeding, and the 3-hour period was insufficient for conducting precipitin tests, they were performed on the following day. The

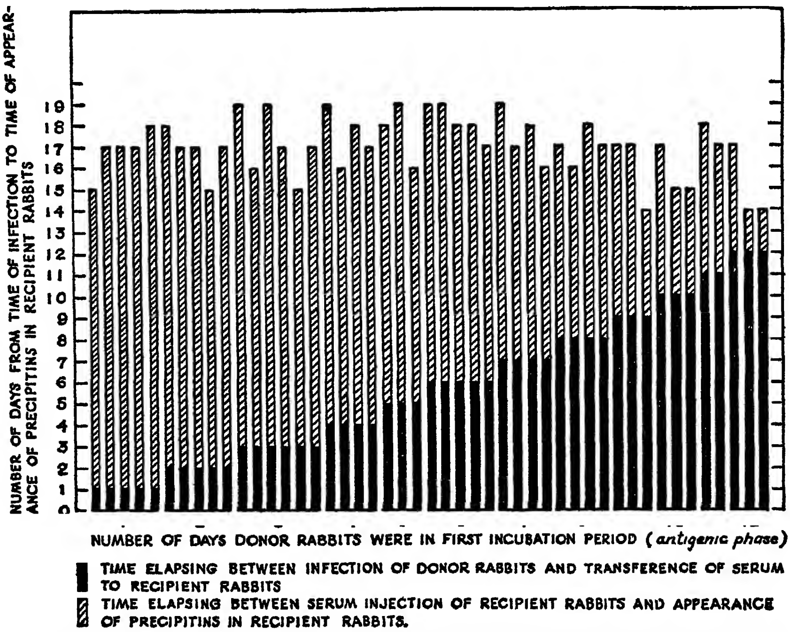

FIGURE 1.—Correlation between time of infection in donor rabbits and time of appearance of precipitins in recipient rabbits.

recipient rabbit was discarded if it appeared that precipitins had been transferred. The appearance of precipitins in 3 donors before the twelfth day (actually the ninth and tenth days) emphasizes the necessity of daily titration for precipitins in the donor's serum.

The donor rabbits were infected with larvae in numbers which varied from 3,440 to 24,792, or the equivalent of 990 to 9,000 larvae per kilogram of body weight. The recipient rabbits received the donors' serum in quantities which varied from 17.48 to 55.00 cc., or a dose equivalent to 10 to 24 cc. per kilogram of body weight.

Experiment A.—The results of the experiment are summarized in table 1. Although the average period required for the development of precipitins in donor rabbits after the feeding of trichina larvae was

14 days, it will be noted that precipitins developed in the recipient rabbits in 15 to 19 days (average 17 days), from the date of the original feeding of the donors. As shown in figure 1, there is a rather definite correlation between the period required for the development of precipitins in the recipient animals and the period of incubation in the infected or donor animals.

In view of the generally accepted opinion that the introduction of an antigen into the circulation is followed by its disappearance after varying intervals of time because of some interaction in antibody formation, it was expected that serum drawn from animals shortly

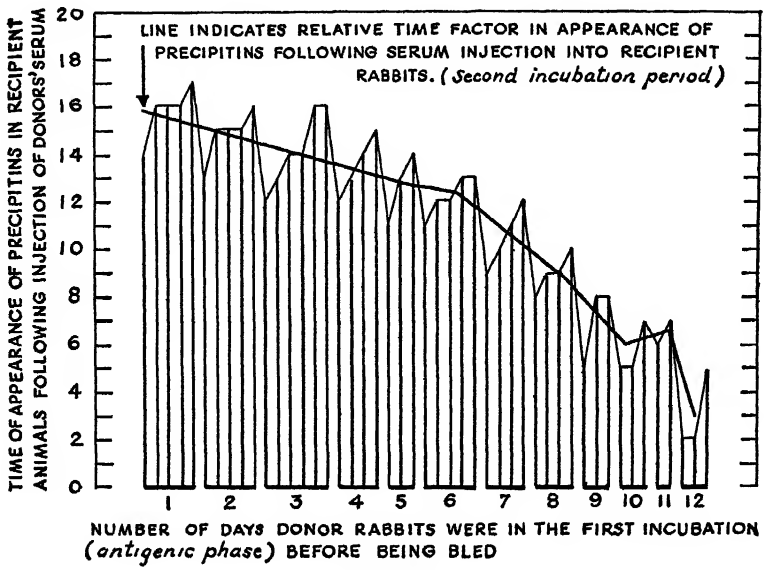

FIGURE 2.

after their infection would contain more antigenic constituents than that withdrawn at later periods. On the contrary, it was found that the introduction of the serum drawn in the later stages of infection was followed by a more rapid development of precipitins in the recipient rabbits. This accelerating characteristic of the donors' serum is shown in figure 2. Particular attention is called to the protocols of rabbits Nos. 23 to 53 in table 1. There would appear to be a modification of the antigen during its period of incubation in the infected donor animal so as to stimulate more rapidly the formation of precipitins in the recipient animal.

The question arises, however, as to whether this increased stimulating property of the antigen is actually due to its modification within the body of the infected animal or whether it is due to an increase in the amount or change in the quality of the antigen. In *Trichinella spiralis* infections, it will be remembered that two sources of antigen

are present. One source is represented by adult parasites located in the intestine of the host, the female worms at least having a longevity of 6 weeks or more, and the other source represented by the multiple broods of larvae which enter the systemic circulation and eventually come to rest in the voluntary muscles of the same host.

TABLE 1.—*The antigenic phase in donor rabbits infected with trichina larvae as demonstrated by the appearance of precipitins in noninfected rabbits injected with the blood serum of the donors*

Donor animals				Recipient animals				
Rabbit No.	Number of larvae fed: Total	Number of larvae fed: Per kilogram of body weight	Number days infection to bleeding	Rabbit No.	Amount of donors' serum injected: Total	Amount of donors' serum injected: Per kilogram of body weight	Appearance of precipitins: Number of days from serum injection	Appearance of precipitins: Number of days from infection of donor
					Cc.	*Cc.*		
1	3,440	990	1	1A	30.00	10.00	14	15
2	3,750	1,530	1	2A	45.00	18.00	16	17
3	6,600	3,000	1	3A	21.90	10.00	16	17
4	11,910	6,000	1	4A	17.48	10.00	16	17
5	18,000	9,000	1	5A	22.95	10.00	17	18
6	3,750	1,290	2	6A	55.00	22.00	16	18
7	3,440	1,990	2	7A	30.00	13.00	15	17
8	7,209	3,000	2	8A	23.22	10.00	15	17
9	7,200	3,760	2	9A	30.00	12.90	13	15
10	11,160	6,000	2	10A	23.45	10.00	15	17
11	5,700	2,500	3	11A	30.00	13.00	13	16
12	3,750	3,000	3	12A	37.00	14.00	16	19
13	6,777	3,000	3	13A	19.45	10.00	16	19
14	9,000	3,770	3	14A	30.00	13.00	14	17
15	7,200	3,950	3	15A	30.00	16.00	12	15
16	11,240	6,000	3	16A	24.21	10.00	14	17
17	3,750	1,890	4	17A	33.00	15.00	15	19
18	5,475	3,000	4	18A	18.50	10.00	12	16
19	12,630	6,000	4	19A	21.44	10.00	14	18
20	16,560	9,000	4	20A	18.30	10.00	13	17
21	3,750	1,323	5	21A	42.00	19.00	13	18
22	6,567	3,000	5	22A	20.20	10.00	14	19
23	22,874	6,000	5	23A	23.65	10.00	11	16
24	3,750	1,360	6	24A	40.00	17.00	13	19
25 [1]	------	------	6	25A	50.00	17.00	13	19
26	4,892	3,000	6	26A	22.14	10.00	12	18
27	24,792	6,000	6	27A	22.85	10.00	12	18
28	18,252	9,000	6	28A	22.63	10.00	11	17
29 [1]	------	------	7	[2] 29A	------	------	12	19
30	3,750	1,470	7	30A	40.00	16.00	10	17
31	11,179	3,000	7	31A	20.00	10.00	(3)	------
32	12,000	6,000	7	32A	20.10	10.00	11	18
33	19,764	9,000	7	33A	20.75	10.00	9	16
34	3,750	1,260	8	34A	42.00	10.00	9	17
35	10,548	3,000	8	35A	22.15	10.00	8	16
36	6,186	3,000	8	36A	22.35	10.00	(4)	(4)
37	12,258	6,000	8	37A	21.90	10.00	10	18
38	17,325	9,000	8	38A	21.75	10.00	9	17
39 [1]	------	------	9	39A	28.00	9.00	8	17
40	3,750	1,370	9	40A	40.00	17.00	8	17
41	6,528	3,000	9	41A	19.50	10.00	5	14
42	13,632	6,000	9	42A	19.16	10.00	(5)	(5)
43 [1]	------	------	10	43A	35.00	10.00	(5)	(5)
44	3,750	1,410	10	44A	40.00	24.00	7	17
45	7,197	3,000	10	45A	19.25	10.00	5	15
46	13,560	6,000	10	46A	20.50	10.00	5	15
47	17,280	9,000	10	47A	22.85	10.00	(5)	(5)
48 [1]	------	------	11	48A	47.00	13.00	7	18
49	3,750	1,390	11	49A	32.00	15.00	6	17
50 [1]	------	------	12	50A	33.00	11.00	5	17
51	3,750	1,240	12	51A	50.00	22.00	(4)	(4)
52	6,135	3,000	12	52A	19.90	10.00	2	14
53	12,486	6,000	12	53A	19.10	10.00	2	14

[1] Some larvae were lost during administration; for this reason, no accurate determination of the dosage could be made. [2] Part of the serum was inadvertently lost during administration. [3] Died. [4] Did not appear. [5] Passive transfer.

A second experiment (B) was performed in order to determine whether any increase occurred in the amount of antigen. The previous procedure was duplicated except that instead of infecting the donor rabbits with living trichina larvae each animal received a single injection of an antigen consisting of an extract of dried pulverized trichina larvae. Under these conditions it was assumed that no multiplication of the antigen could take place in the donor rabbits.

Experiment B.—Five rabbits were injected with a 1:20 dilution of the dried antigen in doses of 1 cc. per kilogram of body weight, and 2 to 5 days later were bled from the heart. The collected serum was injected into a second series of nontreated rabbits in quantities equal to 10 cc. per kilogram of body weight. Tests were made daily for the detection of precipitins in each animal of the two groups. The protocols of the experiment are given in table 2. It will be seen that precipitins developed in the donor animals in 4 to 5 days and in the recipient animals from 3 to 6 days, the total incubation period in both donors and recipients being from 6 to 11 days.

TABLE 2.—*Appearance of precipitins following injection of donor rabbits with a 1:20 dilution of an extract of dried trichina larvae as an antigen and the transfer of the donors' serum to recipient rabbits*

Donor animals				Recipient animals				
Rabbit No.	Amount of extract injected	Appearance of precipitins following injection (days)	Titer of precipitins	Rabbit No.	Incubation period of donors' serum injected (days)	Amount of serum injected	Appearance of precipitins following serum transfer (days)	Titer of precipitins
	Cc.					*Cc.*		
1	2.12	4	1:80	1A	2	18.85	4	1:160
2	2.57	5	1:160	2A	3	19.00	4	1:40
3	2.39	4	1:160	3A	4	19.15	[1] 3	1:160
4	2.07	4	1:80	4A	4	19.10	[1] 3	1:160
5	2.31	5	1:80	5A	5	19.75	[1] 6	1:20

[1] Passive transfer of precipitins occurred as evidenced by precipitin titers of 1:40, 1:12, and 1:12, respectively, 24 hours after injection.

Serum from 3 donor rabbits, Nos. 3, 4, and 5, gave precipitin titers of 1:160, 1:80, and 1:80, respectively, on the day that serum from these animals was transferred to recipient rabbits Nos. 3A, 4A, and 5A. Precipitin tests on the serum of these latter rabbits on the following day gave titers of 1:40, 1:12, and 1:12, respectively. However, precipitins could not be detected in the blood serum of these recipient rabbits at the forty-eighth hour after injection of the donors' serum. Precipitins reappeared at the seventy-second hour after injection in rabbits 3A and 4A when the titers obtained were higher than those found at the twenty-fourth hour.

Precipitins persisted from 9 days to 2 months following their appearance in 4 of the recipient rabbits (table 2). In the fifth animal

(1A), they were still present on the fifth day but were not present 2 weeks later when an additional test was made. Under the conditions of the experiment, the persistence of precipitins over the above-mentioned period would seem to furnish additional evidence against the passive transfer of appreciable quantities of precipitins.

The use of a larger number of animals in experiment B, and the continuation of the experiment over the same period of time as in experiment A, would no doubt have added emphasis to the results obtained. However, relatively large quantities of trichina antigen would have been needed and such quantities were not available because of the demand for the antigen for diagnostic purposes.

Regardless of the limitations of the experiment, the findings would seem to indicate that there had been some modification of the antigen which was transferred in the serum of the donor rabbits. Experiment A has since been duplicated, with human blood serum used as an antigen. The results, which will be published elsewhere, confirm the conclusions made in regard to experiment B.

DISCUSSION

The results of these experiments (experiment B) show that trichina antigen is not lost from the sera of inoculated animals within 5 days after its introduction. Following the feeding of trichina larvae (experiment A) it was not lost within 12 days. This is contrary to the generally accepted opinion that antigen disappears rapidly after its introduction into the animal because of excretion, denaturation, or its interaction in antibody formation.

The question arises as to whether the antibody production in recipient animals was due to progressive development of antigen in the larvae-infected animals, a quantitative factor, or whether it was the result of a change in the quality or character of the antigen.

In this connection no relation was found between the number of larvae fed or the dose of serum transferred and the time required for development of precipitins. In the few animals injected with the same dosage of antigen on a weight basis there was no uniformity in the time of appearance of precipitins. Since there is no migration of larvae from the intestine within 4 days after the feeding, it is evident that there could have been no increase of antigen because of larvae invasion during this period. Nevertheless, the relationship between the length of the antigenic phase in the donor animals and that of precipitin formation in the recipient animals remained unchanged. It may appear that the longer antigenic phase may be marked by the presence of a greater amount of antigen in the serum and thus result in the production in the recipient animals of an

earlier precipitin response. Kahn (*11*), on the other hand, believes that an animal will develop immunity responses more quickly to smaller doses of antigen than to greater quantities. Again, the number of larvae given any one animal may not bear any relation to its reaction in either the production of antigen or antibodies or in its susceptibility to infection, since animals vary in their individual response to dosage of equal quantities.

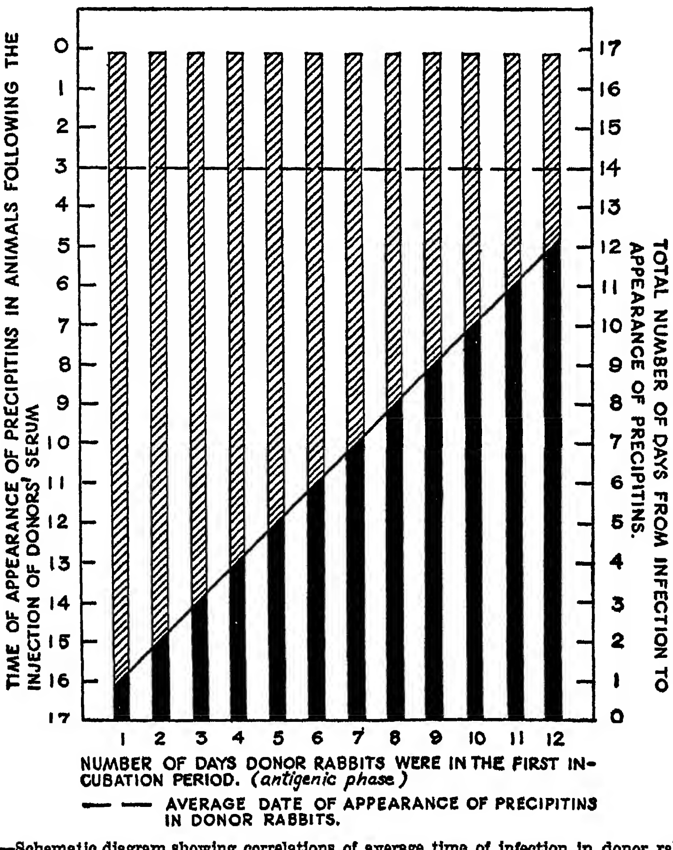

FIGURE 3.—Schematic diagram showing correlations of average time of infection in donor rabbits and average time of appearance of precipitins in recipient rabbits.

While these experiments do not offer conclusive evidence against the possibility of quantitative factors in the speed of production of precipitins, the rather consistent inverse relationship between the length of the first incubation period and that of the second incubation period together with the constancy of the total period for precipitin production suggests that the antigen is modified in proportion to the length of time it is in the serum of the original donor animal. This inverse relationship is illustrated schematically in figure 3.

There seems to be ample evidence that the reactions in the recipient animals were not due to the transfer of precipitins because, aside from the technical exclusion of the latter, the animals receiving the serum later responded to a second antigen stimulation similar to that occurring in animals actively immunized.

SUMMARY

Antigens have been demonstrated in rabbits as early as 24 hours after the feeding of trichina larvae. The presence and persistence of these antigens in the serum for several days previous to the active development of precipitins has been shown by the injection of their serum into other noninfected rabbits, with the subsequent development of precipitins in the latter. This period of antigen circulation has been referred to as the antigenic phase. The length of the antigenic phase bears a relationship to the speed of production of precipitins in the recipient animals. The total period between the infection of the primary animal and the appearance of precipitins in the recipient animal is relatively constant. The possible bearing which both quantitative and qualitative factors may have in connection with these results is discussed.

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THE OCCURRENCE OF *ANOPHELES DARLINGI* ROOT IN BRITISH HONDURAS AND GUATEMALA

By W. H. W. Komp, *Senior Medical Entomologist, United States Public Health Service*

In October and November 1939, Mr. Ivan Sanderson of the British Museum made several collections of mosquitoes at his camp on Dog Creek, at the base of the foothills just south of Stann Creek, in British Honduras. The specimens were sent to the writer for identification by Dr. R. L. Cheverton, senior medical officer, at Belize, British Honduras. Among the material were 9 adult specimens of an Anopheline mosquito tentatively identified as *Anopheles argyritarsis* R.-D. Fortunately, a single male was present in the series, and dissection and examination of the male terminalia showed that it was in every respect like the males of *Anopheles darlingi* Root collected previously by the writer in Venezuela and British Guiana.

Anopheles darlingi is the most dangerous vector of malaria in Brazil (except the imported *A. gambiae*) and in British Guiana and Venezuela. In Belem, Para, Brazil, Davis (*1*) found 22 percent of 220 dissected specimens to be infected. Davis and Kumm (*2*) dissected 240 specimens at França, Bahia, Brazil, and found 28.7 percent infected. At Itapira, Bahia, Brazil, Kumm (*3*) found 3 out of 5 specimens infected. Shannon (*4*) found 9 percent infected at Porto Velho, Amazonas, Brazil. This mosquito has also been reported by Bennaroch (*5*) as naturally infected in Venezuela. In Panama and elsewhere, the principal Anopheline vector of malaria, *Anopheles albimanus* Wied., has been found naturally infected in percentages ranging from 1 to 2.5 percent. The superior ability of *A. darlingi* as a vector of malaria is evident from these figures.

The northern range of *A. darlingi* has hitherto been considered as British Guiana and Venezuela, with one or two unconfirmed records from Colombia. It is not known from Panama or Costa Rica, or any of the other Central American countries. Its occurrence as far north as British Honduras was entirely unexpected, and because of its proved dangerous abilities as a malaria vector in South America an attempt to verify its presence in British Honduras was deemed advisable. Accordingly, the writer visited British Honduras, and in company with Dr. Vernon Anderson of the Department of Health went to the locality where the adults of *A. darlingi* had previously been found. On March 18, 1940, larvae and pupae corresponding in every respect to the published descriptions of the species (*6*), and to specimens in the writer's collection from South America, were found in side pools along Silk Grass Creek, about 200 yards from the camp of the Silk Grass Forest Reserve, which is about 2 miles from Sanderson's camp on Dog Creek. Later, larvae were found in small numbers,

but widely distributed, in pools along Silk Grass Creek below Silk Grass camp. Seven female adults, all blood-gorged, were taken in bed nets of the camp personnel and in the partly screened sleeping quarters of the party, and one female was captured attempting to bite. None were taken with horse bait.

Most of British Honduras was suffering from a severe drought, the dry season having been unusually severe. Many potential breeding places of *A. darlingi* were noted in and about the camp at Silk Grass Reserve. No specimens of larvae or adults were taken at Stann Creek Village, although *A. albimanus* was breeding freely in the lagoon behind the town.

The occurrence of *A. darlingi* elsewhere in the region is very probable. Through the courtesy of Dr. J. R. de Leon and Dr. Julio Herrera of the Departamento de Sanidad of Guatemala, the writer was permitted to examine their collections of mosquitoes from Guatemala. A series of 6 female specimens labeled "*albitarsis*?" and collected at Panzos, Guatemala, was found in the collections. Panzos is a town of some 3,000 situated about 50 kilometers west of El Estor, on the Rio Polochic above its entrance into Lago de Izabal (Golfo Dulce) and some 80 miles west of Puerto Barrios, on the Atlantic coast of Guatemala. These females lacked the two lines of white scales on the first abdominal sternite, characteristic of *A. albitarsis* L. Arrib., and differed in color markings from the specimens of *A. argyritarsis* R.-D. as found in Guatemala. They resembled in every respect the female *darlingi* collected by the writer at Silk Grass camp in British Honduras. It is therefore extremely probable that *A. darlingi* is present over a wide area of the neighboring coastal lowlands.

The larval and adult specimens from British Honduras, and 2 females from Panzos, Guatemala, were submitted to Dr. H. W. Kumm, who has had extensive experience with *A. darlingi* in Brazil. He confirmed the writer's identification of the material as *A. darlingi*.

The occurrence of *A. darlingi* so far north of its usual range is unexplained, and its distribution should be further investigated in view of its dangerous powers as a carrier of malaria. A full account of the conditions under which *A. darlingi* was found in British Honduras will be published elsewhere.

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SOME STATE LEGISLATION IN 1939 AFFECTING PUBLIC HEALTH

A summary of the more important State legislation of interest to physicians, enacted or proposed in 1939, appeared in the Journal of the American Medical Association for March 9, 1940 (pp. 875–889),[1] two sections of which relate to (1) health insurance, medical and hospital service plans, and care for the indigent sick, and (2) additional measures for the control of certain communicable diseases.

COMPULSORY AND VOLUNTARY HEALTH INSURANCE

Bills providing for some type of compulsory and voluntary health insurance failed of enactment in California, Connecticut, Massachusetts, New York, Pennsylvania, Rhode Island, and Wisconsin. In most of the bills, certain persons were excluded from the compulsory feature but were entitled to voluntary participation.

The life of the committee authorized by New York laws, 1938, to investigate health requirements and recommend health insurance proposals was extended to March 15, 1940; but bills to create similar commissions failed in Connecticut and Ohio.

VOLUNTARY MEDICAL SERVICE PLANS

Laws were enacted in Connecticut, Michigan, New York, Pennsylvania, and Vermont permitting nonprofit corporations which are so authorized by a designated State agency to operate, on a prepayment basis, nonprofit medical service plans whereby stated medical services can be rendered to subscribers. With some exceptions, these plans provide, in general, that the subscribers may have the services of physicians of their own choice and that the corporation is to pay the bills. Laws were enacted in Missouri and Arkansas permitting designated groups to provide medical and hospital services for their members.

Similar bills failed of enactment in California, Illinois, Ohio, Utah, Washington, and Wisconsin, and bills authorizing such plans for osteopathic care failed in Michigan and Pennsylvania.

VOLUNTARY HOSPITAL SERVICE PLANS

Laws authorizing the formation of nonprofit corporations to provide, on a prepayment basis, hospital care to their members or subscribers were enacted in Alabama, Connecticut, Florida, Iowa, Maine, Michigan, New Hampshire, New Mexico, Ohio, Rhode Island, South Carolina, Texas, Vermont, and Wisconsin.

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[1] Legislation of Interest to Physicians Considered by State Legislatures in 1939. Prepared by T. V. McDavitt, of the Bureau of Legal Medicine and Legislation, American Medical Association.

Similar bills failed of enactment in nine States, and attempts to legalize like activities of organizations already operating hospital service plans were unsuccessful in two States.

Maryland adopted a resolution requesting the Governor to appoint a commission to study the question of compulsory hospital insurance, the prior California nonprofit hospital service plan law was amended, extending the scope and definition of "hospital services," and the Massachusetts nonprofit hospital service plan law was amended to require the State commissioner of insurance to approve contracts issued and rates charged by the hospital service plan corporation.

FREE CARE OF THE INDIGENT SICK OR THE GENERAL PUBLIC

A new Michigan law requires the several counties to provide for the rendering of medical care to indigents, defines the service, and provides for the maintenance of the private physician-patient relationship. A new Indiana law provides for care, in certain cases, by any hospital operated by the trustees of the Indiana State University, the cost to be borne by the county from which the patient is committed. Four States (Delaware, Florida, North Carolina, and South Carolina) passed laws authorizing specified counties to levy taxes to be used for medical and hospital treatment of the indigent sick.

Bills regarding State-wide plans for medical care failed of enactment in New York and California.

SPECIAL TREATMENT AND CONTROL OF DISEASE

Laws were enacted in Connecticut, Illinois, Indiana, and New Jersey appropriating money to the State board or department of health for the purchase and free distribution of pneumococcus serum for the treatment of persons afflicted with pneumonia and financially unable to purchase the serum. The Indiana laws authorize the distribution also of diphtheria toxoid, smallpox virus, and typhoid bacterins. A Florida law appropriated $10,000 to the State board of health for the purchase and distribution of insulin to persons needing it and financially unable to purchase it. A somewhat similar bill failed of passage in Wisconsin. A new Connecticut law authorized the State department of health to furnish such treatment to indigent typhoid or paratyphoid fever germ carriers as may be necessary to relieve them of the carrier state. A Pennyslvania bill authorizing the department of welfare to supply hearing aids or devices to needy persons unable to purchase them was killed, as were two New York bills regarding care and appliances in poliomyelitis, and two other bills imposing on counties or other political subdivisions the duty of supplying needed "physical repair" to physically handicapped unemployed adult persons and requiring the State to reimburse the local political subdivision by 75 percent of the total expended by them for such purpose.

VENEREAL DISEASES

Premarital examinations.—In the control of venereal diseases, laws requiring premarital examinations for syphilis were enacted in California, Colorado, Indiana, North Carolina, North Dakota, Pennsylvania, South Dakota, Tennessee, and West Virginia. The North Carolina and Tennessee laws relate to all venereal diseases. Proposals to condition the issuance of a license to marry on the presentation, by both parties to the proposed marriage, of a physician's certificate as to freedom from an infectious stage of a stated venereal disease were rejected in 16 other States.

Existing laws requiring premarital examinations were amended in Illinois, Michigan, and New York.

Blood tests of pregnant women.—Laws requiring the submission of blood specimens of pregnant women were enacted in California, Colorado, Delaware, Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, North Carolina, Oklahoma, Pennsylvania, South Dakota, and Washington. Similar bills failed in six other States.

Reporting.—A new Alabama law requires a physician, hospital, dispensary, or penal or other institution to report immediately to the county health officer a case of syphilis, gonorrhea, chancroid, venereal lymphogranuloma, or granuloma venereum. A similar bill failed in New Jersey.

Compulsory treatment.—An Alabama law authorizes the county health officer to require all persons infected with a venereal disease to undergo treatment by a licensed physician, such treatment to be at public expense if a patient is unable to pay.

Free treatment for indigents.—A Florida law authorizes counties of certain populations to provide medical treatment at county expense for all indigent residents suffering from venereal disease.

State facilities for diagnosis.—A new Oregon law amends a prior law. The prior law directed the State board of health to provide free facilities for laboratory examinations for diagnosing venereal disease and to provide the necessary materials for treatment to persons whom the attending physician certifies are unable to pay therefor. The amendment requires, as a condition precedent to supplying such services and materials, that the attending physician certify that he will make no charge to the patient for the treatment of the disease for which the test is made. In Florida and Utah, bills were killed which provided for free distribution of antisyphilitic drugs to persons unable to pay; and an Indiana bill, requiring the submission of blood samples for serologic test every 2 years by all physicians, dentists, and nurses, failed of enactment.

Appropriation for eradication of venereal diseases.—A new Colorado law appropriated $12,000 to the State board of health for the period

ending June 30, 1941, to be used for venereal disease control work. A bill in Texas, appropriating $150,000 to the State department of health for similar work, failed of enactment.

FOOD HANDLERS

A new Texas law prohibits the employment in any public eating or sleeping place, or place where food, drink, or candy is prepared or stored, of any person having an infectious or contagious disease. Such employees must present a physician's certificate every 6 months. Similar bills failed in five States.

DIPHTHERIA IMMUNIZATION

A compulsory diphtheria immunization law for children up to 5 years of age was passed in North Carolina, the county health officer to administer the prophylactic free of charge if the parents or guardians are financially unable to pay. A New Jersey law authorizes any board of education to condition school attendance on proof of immunity to diphtheria. Such board may provide, free of cost, materials and services for the required immunization.

CANCER

Laws directed at the control of cancer were enacted in four States. In Illinois, a division of cancer control was created in the State department of health, the receipt and expenditure of voluntary contributions were authorized, and an appropriation of $25,400 was made for the establishment of a cancer diagnostic service. In Wisconsin, provision was made for an annual appropriation of $10,000 for cancer research. A South Carolina law authorizes the State board of health to establish standards for cancer units in general hospitals, to provide financial aid for indigent cancer patients in such cancer units, to establish the necessary facilities for the treatment and cure of cancer patients, and to conduct educational programs. In Vermont, a State cancer commission was created which was authorized to establish and conduct cancer clinics in the State to care for indigent cancer patients and to grant aid to patients who are not wholly indigent but who cannot provide adequate care for themselves. An appropriation of $10,000 was made to the commission for each of the next 2 years.

EXAMINATION OF PUBLIC SCHOOL PUPILS AND EMPLOYEES

A New Jersey law requires local boards of education to determine the presence of tuberculosis in communicable form in the pupils under their jurisdiction. Any pupil found to have tuberculosis in a communicable stage must be excluded, and can be readmitted only when free from the disease in a communicable stage, when physically competent to engage in school activities, and when no longer a menace to the health of other pupils. Another law in New Jersey provides

that, in conducting the examinations required by law, the medical inspector may require pupils to loosen, open, or remove their clothing above the waist, provided the parents or guardians are notified and the examination is conducted in their presence or in the presence of a nurse or teacher. Still another New Jersey law authorizes boards of education to require a physical examination of all employees of the board at least once in 3 years. In case of mental abnormality or a communicable disease, the employee is ineligible for further service until proof of recovery is furnished.

Unsuccessful attempts were made in 3 States to require all public school teachers to undergo annual physical examinations and to submit to blood tests for tuberculosis and venereal disease.

BUREAUS OR DIVISIONS OF INDUSTRIAL HYGIENE

Idaho and Montana enacted laws establishing a bureau or division of industrial hygiene in the department of public welfare and State board of health, respectively.

Citations to these laws are given by Mr. McDavitt, who also discusses State legislation in 1939 relating to drugs, foods, cosmetics, and therapeutic devices, and to licenses for the practice of the healing art.

DR. W. H. SEBRELL WINS AWARD FOR VITAMIN B STUDIES

An honor for achievement in nutritional research has recently been conferred on Surg. W. H. Sebrell, of the United States Public Health Service, who shares the Mead Johnson & Co. award for "the most outstanding work on vitamin B complex in North America" in 1939. This honor, which carries a pecuniary award of $1,000, is shared equally between Doctor Sebrell and a group of five workers at the laboratories of Merck & Co., Rahway, N. J., and was bestowed in recognition of research on riboflavin deficiency in man

In Dr. Sebrell's work, which was first reported in a preliminary note published in the Public Health Reports for December 30, 1938, and more fully presented in the issue of December 1, 1939, the condition caused by riboflavin deficiency was identified and described and methods of prevention and treatment were demonstrated.

The presentation of the award was made, on behalf of the award committee, by Dr. E. V. McCollum, of the School of Hygiene, Johns Hopkins University, at the meeting of the American Institute of Nutrition in New Orleans, La., on March 13, 1940.

The vitamin B awards are being presented annually over a period of 5 years by the Mead Johnson & Co., of Evansville, Ind. The first award was made in 1939, to Dr. C. A. Elvehjem, of the University of Wisconsin, for his discovery in connection with the use of nicotinic acid in the prevention of pellagra.

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COURT DECISION ON PUBLIC HEALTH

Pneumonia held not to result from "accident" within meaning of workmen's compensation act.—(Pennsylvania Supreme Court; *Parks* v. *Miller Printing Mach. Co. et al.*, 9 A.2d 742; decided December 4, 1939; rehearing denied December 29, 1939.) Recovery of compensation under the workmen's compensation act was sought for the death of an employee from pneumonia. Because of a flood the machinery in the employer's plant became covered with mud and dirt. After the waters had receded the regular employees, including decedent, were directed to clean their machines. The decedent started on this work about a week after the flood had occurred but the floors were still damp and muddy. After working for about 8 days he became ill with pneumonia, which was attributed by the attending physician to the conditions under which the decedent had been working. The decedent's death occurred shortly thereafter as a result of the pneumonia. The supreme court denied compensation on the ground that there had been no "accident" within the meaning of the workmen's compensation act. In the course of the opinion the court said:

> * * * While, in the present case, it was the flood which made necessary the cleaning of the machinery, this operation was a protracted labor, and those who engaged in it voluntarily and deliberately exposed themselves to the dampness which they knew existed. Decedent worked for 8 days before he became ill, returning to the job each day in the usual fashion. Nor can the surrounding conditions during that time be fairly characterized as extraordinary. There was no sudden, intense exposure to water or to cold. The most that can be said is that there was dampness in the plant and mud on the floors as lingering effects of the flood. * * *

DEATHS DURING WEEK ENDED MARCH 30, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Mar. 30, 1940	Corresponding week, 1939
Data from 88 large cities of the United States.		
Total deaths	9,081	9,274
Average for 3 prior years	9,075	
Total deaths, first 13 weeks of year	123,083	123,277
Deaths under 1 year of age	514	553
Average for 3 prior years	573	
Deaths under 1 year of age, first 13 weeks of year	6,712	7,220
Data from industrial insurance companies:		
Policies in force	65,901,954	67,699,350
Number of death claims	13,732	17,021
Death claims per 1,000 policies in force, annual rate	10.9	13.1
Death claims per 1,000 policies, first 13 weeks of year, annual rate	10.7	11.3

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED APRIL 13, 1940

Summary

Reports received from the State health officers for the week ended April 13, 1940, indicate little change from the preceding week with respect to the 9 important communicable diseases included in the following weekly table. The incidence of each of these diseases for the current week is below the 5-year median expectancy based on the years 1935–39, is lower than for the preceding week for influenza, meningococcus meningitis, poliomyelitis, and scarlet fever (diphtheria approximately the same), and lower than for the corresponding week last year for all but scarlet fever and whooping cough. The cumulative totals for the first 15 weeks ending with the current week are below the 5-year (1935–39) median expectancy for all of these diseases except influenza and poliomyelitis.

As compared with 1938, the year with the record low general mortality rate for the United States, health conditions so far this year have been almost equally as good as interpreted by the incidence of most of the important communicable diseases. However, more than four times as many cases of influenza have been reported this year as in the same period in 1938, and the general weekly mortality in large cities reported by the Bureau of the Census has remained consistently above that for the corresponding period of 1938.

For the current week 72 cases of smallpox were reported, of which 18 occurred in Colorado and 19 in Iowa. For the preceding week 47 cases were reported—11 in Iowa, 5 in Illinois, and 4 in Colorado. Eleven cases of endemic typhus fever were reported, 6 cases of undulant fever (brucellosis), and 4 cases of Rocky Mountain spotted fever in western States.

Telegraphic morbidity reports from State health officers for the week ended April 13, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Apr. 13, 1940	Apr. 15, 1939		Apr. 13, 1940	Apr. 15, 1939		Apr. 13, 1940	Apr. 15, 1939		Apr. 13, 1940	Apr. 15, 1939	
NEW ENG.												
Maine	1	2	2	2	157	19	533	15	114	0	0	0
New Hampshire	0	0	0	-------	-------	-------	93	17	18	0	0	0
Vermont	0	1	1	-------	-------	-------	6	48	48	0	0	0
Massachusetts	6	3	6	-------	-------	-------	604	1,032	714	0	1	2
Rhode Island	2	1	1	-------	-------	-------	156	51	75	0	0	1
Connecticut	1	0	3	5	16	7	89	821	517	1	0	0
MID. ATL.												
New York	11	30	34	[1] 14	[1] 27	[1] 14	641	1,839	2,842	4	3	10
New Jersey	5	9	14	10	13	9	533	57	977	0	0	2
Pennsylvania	25	23	33	-------	-------	-------	211	139	863	8	16	10
E. NO. CEN.												
Ohio	11	15	17	78	-------	28	27	25	900	0	0	14
Indiana	2	6	11	24	99	30	5	26	203	0	2	2
Illinois	17	33	30	13	57	35	92	26	209	1	1	8
Michigan [2]	3	12	11	25	15	7	464	324	324	0	3	4
Wisconsin	0	0	3	134	154	60	463	581	581	0	1	1
W. NO. CEN.												
Minnesota	2	1	2	8	2	1	178	754	230	0	0	1
Iowa	9	16	10	9	18	2	870	282	196	0	0	2
Missouri	5	3	15	-------	18	103	71	14	31	3	1	1
North Dakota	3	1	1	28	38	13	10	26	26	0	1	0
South Dakota	3	10	2	-------	12	-------	9	239	0	0	0	0
Nebraska	0	9	3	-------	14	1	24	67	70	0	0	1
Kansas	4	4	8	21	28	18	597	47	47	2	0	1
SO. ATL.												
Delaware	0	0	0	-------	-------	-------	1	3	13	0	0	0
Maryland [3]	1	2	6	11	24	9	8	440	247	1	1	4
Dist. of Col.	2	4	4	-------	2	1	3	200	68	0	0	8
Virginia	13	9	10	328	385	-------	102	480	608	2	0	10
West Virginia [3]	10	5	9	59	238	69	18	8	61	4	2	6
North Carolina	12	12	15	14	43	43	177	538	253	0	0	2
South Carolina	11	8	4	442	803	331	27	48	42	0	0	0
Georgia [3]	10	6	7	94	763	201	89	155	0	0	0	1
Florida [3]	3	4	4	7	9	2	127	95	82	0	0	8
E. SO. CEN.												
Kentucky	2	9	11	10	79	84	93	28	315	0	2	7
Tennessee [4]	4	5	6	96	296	154	145	62	60	1	0	2
Alabama [3]	9	12	10	142	697	365	144	134	134	4	0	3
Mississippi [2]	5	4	5	-------	-------	-------	-------	-------	-------	1	0	2
W. SO. CEN.												
Arkansas	7	4	4	99	280	82	24	62	62	0	1	1
Louisiana	9	16	13	25	85	85	5	198	62	1	1	1
Oklahoma	5	7	7	171	179	133	18	202	146	1	2	8
Texas [3]	17	12	36	641	1,007	646	882	395	483	0	2	6
MOUNTAIN												
Montana	1	0	1	12	41	41	23	235	16	0	0	0
Idaho	3	0	1	5	2	4	52	94	24	0	0	0
Wyoming [4]	2	0	0	-------	-------	-------	29	92	46	0	0	0
Colorado [4] [5]	12	14	9	23	35	-------	25	530	315	0	2	1
New Mexico	4	0	3	-------	23	15	29	28	35	1	1	1
Arizona	1	5	2	93	151	53	53	38	40	0	0	0
Utah [2]	0	0	0	7	42	-------	636	110	23	0	1	0
PACIFIC												
Washington	0	0	0	-------	10	1	763	797	228	0	0	1
Oregon [4]	5	2	3	11	44	44	642	70	70	0	0	0
California	14	16	20	186	145	145	455	3,482	1,645	1	3	3
Total	272	335	398	2,842	6,141	3,201	9,746	15,056	15,056	36	47	158
15 weeks	5,485	7,242	8,547	155,283	129,527	115,788	95,996	196,334	196,334	595	766	1,984

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 13, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Apr. 13, 1940	Apr. 15, 1939		Apr. 13, 1940	Apr. 15, 1939		Apr. 13, 1940	Apr. 15, 1939		Apr. 13, 1940	Apr. 15, 1939	
NEW ENG.												
Maine	0	0	0	13	20	18	0	0	0	0	2	2
New Hampshire	0	0	0	7	3	10	0	0	0	0	0	0
Vermont	0	0	0	3	14	9	0	0	0	0	0	0
Massachusetts	0	0	0	187	200	308	0	0	0	0	1	1
Rhode Island	0	0	0	12	14	18	0	0	0	0	0	0
Connecticut	0	0	0	97	102	105	0	0	0	3	0	0
MID. ATL.												
New York	1	0	0	998	601	1,034	0	0	0	5	9	6
New Jersey	0	0	0	435	214	214	0	0	0	3	4	1
Pennsylvania	0	0	0	482	295	625	0	0	0	6	3	7
E. NO. CEN.												
Ohio	1	0	0	310	408	408	1	19	2	4	1	4
Indiana	0	0	0	162	172	172	0	33	14	5	1	1
Illinois	0	1	1	773	514	789	0	10	10	1	3	4
Michigan [2]	1	0	0	373	474	474	0	3	3	0	2	4
Wisconsin	0	0	0	122	175	289	2	0	7	2	0	2
W. NO. CEN.												
Minnesota	0	0	0	29	52	163	3	4	6	1	1	0
Iowa	0	0	0	78	186	204	19	47	47	1	0	0
Missouri	0	1	0	41	68	167	3	36	23	1	2	2
North Dakota	0	0	0	7	13	17	0	5	5	1	1	0
South Dakota	0	0	0	17	23	23	2	11	11	0	1	0
Nebraska	0	0	0	15	27	36	0	31	24	0	0	0
Kansas	0	1	0	52	81	158	0	3	37	2	1	1
SO. ATL.												
Delaware	0	0	0	5	7	11	0	0	0	0	0	0
Maryland [2]	0	0	0	35	47	58	0	0	0	1	1	1
District of Columbia	0	0	0	25	18	21	0	0	0	0	1	1
Virginia	0	0	0	39	29	41	0	0	0	3	3	3
West Virginia [2]	2	1	0	66	29	39	0	2	0	1	0	3
North Carolina	0	0	0	28	18	22	0	0	0	0	3	2
South Carolina	0	3	0	0	6	6	0	0	0	2	3	3
Georgia [3]	0	0	0	12	14	8	0	0	0	4	1	3
Florida [3]	0	0	0	4	9	6	0	0	0	0	5	3
E. SO. CEN.												
Kentucky	0	0	0	79	80	47	0	9	2	5	5	5
Tennessee [3]	1	1	1	80	66	28	6	1	0	4	0	5
Alabama [3]	0	0	0	15	12	7	1	0	0	3	8	2
Mississippi [2]	1	0	1	7	2	6	2	0	0	1	0	5
W. SO. CEN.												
Arkansas	0	0	0	4	3	3	3	1	0	4	1	0
Louisiana	0	0	0	7	12	12	0	1	0	3	10	10
Oklahoma	0	0	0	83	24	24	0	34	7	2	1	1
Texas [3]	0	2	1	25	40	118	5	17	11	2	16	13
MOUNTAIN												
Montana	0	0	0	30	9	18	0	1	9	2	0	0
Idaho	0	0	0	16	6	11	1	3	3	1	0	0
Wyoming [4]	0	0	0	4	3	7	0	0	2	2	0	0
Colorado [4] [5]	0	0	0	44	34	43	18	1	4	3	0	0
New Mexico	0	0	0	16	5	14	0	0	0	1	1	0
Arizona	0	1	0	6	2	16	0	0	0	1	1	0
Utah [2]	1	0	0	15	21	40	0	0	0	0	0	0
PACIFIC												
Washington	1	0	0	44	39	39	0	4	15	1	1	1
Oregon [4]	0	0	0	14	26	53	1	4	4	0	3	2
California	2	3	4	129	192	213	5	26	18	4	3	4
Total	11	19	19	4,995	4,409	7,138	72	306	306	85	99	99
15 weeks	386	230	307	71,706	77,735	103,233	1,073	5,421	4,698	1,165	1,741	1,741

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 13, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued.

Division and State	Whooping cough, week ended— Apr. 13, 1940	Whooping cough, week ended— Apr. 15, 1939	Division and State	Whooping cough, week ended— Apr. 13, 1940	Whooping cough, week ended— Apr. 15, 1939
NEW ENG.			SOUTH ATLANTIC—continued		
Maine	38	78	South Carolina	21	82
New Hampshire	20	4	Georgia [3]	14	32
Vermont	28	36	Florida [3]	19	31
Massachusetts	175	192			
Rhode Island	5	65	EAST SOUTH CENTRAL		
Connecticut	24	111	Kentucky	115	10
MID. ATL.			Tennessee [3]	55	30
New York	440	430	Alabama [3]	31	15
New Jersey	99	329	Mississippi [2]	---------	---------
Pennsylvania	357	308	WEST SOUTH CENTRAL		
E. NO. CEN.			Arkansas	24	24
Ohio	174	157	Louisiana	43	11
Indiana	41	57	Oklahoma	20	1
Illinois	114	260	Texas [3]	386	90
Michigan [1]	137	149	MOUNTAIN		
Wisconsin	91	192	Montana	3	5
W. NO. CEN.			Idaho	15	4
Minnesota	30	49	Wyoming [4]	3	5
Iowa	9	17	Colorado [4] [5]	22	68
Missouri	7	25	New Mexico	45	9
North Dakota	12	8	Arizona	37	24
South Dakota	2	1	Utah [2]	119	29
Nebraska	8	2	PACIFIC		
Kansas	50	21	Washington	55	22
SOUTH ATLANTIC			Oregon [4]	39	12
Delaware	2	16	California	305	193
Maryland [2]	180	23	Total	3,617	3,584
District of Columbia	10	27			
Virginia	38	56			
West Virginia [2]	49	57			
North Carolina	106	222	15 weeks	44,968	61,897

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Apr. 13, 1940, 11 cases as follows: Georgia, 4; Florida, 3; Tennessee, 1; Alabama, 2; Texas, 2.
[4] Rocky Mountain spotted fever, week ended Apr. 13, 1940, 3 cases as follows: Wyoming, 2; Colorado, 1; Oregon, 1.
[5] Colorado tick fever, week ended Apr. 13, 1940, Colorado, 2 cases.

WEEKLY REPORTS FROM CITIES

City reports for week ended Mar. 30, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	147	438	100	8,015	837	2,440	26	392	20	1,231	--------
Current week	54	237	61	2,001	506	2,023	1	344	15	863	--------
Maine:											
Portland	0	------	0	83	1	2	0	0	0	3	33
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	10
Manchester	0	------	1	10	2	2	0	1	0	0	28
Vermont:											
Barre	0	------	0	0	0	0	0	2	0	0	6
Burlington	0	------	0	0	0	0	0	0	0	0	8
Rutland	0	------	0	0	1	0	0	0	0	0	7
Massachusetts:											
Boston	0	------	0	65	16	55	0	13	2	27	243
Fall River	1	------	0	86	2	1	0	2	0	11	26
Springfield	0	------	0	0	2	4	0	0	0	1	35
Worcester	0	------	0	3	10	8	0	1	0	7	49
Rhode Island:											
Pawtucket	0	------	0	0	0	1	0	0	0	0	14
Providence	0	------	1	118	6	12	0	2	0	8	66
Connecticut:											
Bridgeport	0	1	1	0	1	4	0	1	1	0	42
Hartford	0	------	0	0	2	4	0	0	0	4	39
New Haven	0	2	1	0	3	2	0	1	0	0	47
New York:											
Buffalo	0	------	1	0	11	12	0	0	0	4	152
New York	10	15	6	77	84	656	0	87	4	120	1,500
Rochester	0	1	0	3	4	6	0	1	0	8	74
Syracuse	0	------	0	0	5	5	0	0	0	4	50
New Jersey:											
Camden	0	2	2	0	0	13	0	0	0	4	30
Newark	0	5	0	257	7	39	0	6	0	5	114
Trenton	0	------	0	0	7	5	0	1	0	0	53
Pennsylvania:											
Philadelphia	2	7	2	37	25	97	0	22	1	35	558
Pittsburgh	1	8	1	0	16	23	0	9	0	8	231
Reading	0	------	1	1	1	0	0	0	0	9	40
Scranton	0	------	--------	0	-------	0	0	-------	0	0	-------
Ohio:											
Cincinnati	1	1	2	5	10	14	0	5	0	18	121
Cleveland	1	29	0	3	9	23	0	9	0	31	206
Columbus	0	2	2	0	6	7	0	4	1	7	93
Toledo	0	------	0	1	8	41	0	6	0	17	82
Indiana:											
Anderson	0	------	0	0	1	2	0	0	0	4	9
Fort Wayne	1	------	1	0	5	1	0	1	0	5	34
Indianapolis	1	------	2	8	5	22	0	6	0	8	110
Muncie	0	------	1	0	2	2	0	1	0	2	19
South Bend	0	------	0	0	0	0	0	0	0	0	20
Terre Haute	0	------	0	0	1	2	0	0	0	2	26
Illinois:											
Alton	1	------	0	0	0	0	0	0	0	4	11
Chicago	5	8	3	34	30	601	0	40	1	60	746
Elgin	1	------	0	1	0	3	0	0	0	0	11
Moline	0	------	0	0	0	4	0	0	0	0	6
Springfield	0	------	0	0	1	3	0	0	0	5	14
Michigan:											
Detroit	2	1	4	35	13	63	0	12	0	12	273
Flint	0	------	0	0	2	25	0	0	0	15	26
Grand Rapids	0	------	0	11	3	24	0	0	0	9	31
Wisconsin:											
Kenosha	0	------	0	11	0	0	0	0	0	0	9
Madison	0	------	0	1	0	1	0	0	0	5	19
Milwaukee	0	1	1	7	6	25	0	0	0	0	104
Racine	0	------	0	1	0	1	0	0	0	1	13
Superior	0	------	0	78	1	0	0	0	0	0	5
Minnesota:											
Duluth	0	------	0	137	2	1	0	1	1	1	24
Minneapolis	0	------	0	3	9	25	0	1	0	2	116
St. Paul	0	------	0	0	5	13	0	2	0	22	72

City reports for week ended Mar. 30, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Iowa:											
Cedar Rapids	0	------	------	33	------	8	0	------	0	0	------
Davenport	2	------	------	12	------	1	0	------	0	0	------
Des Moines	0	------	0	13	0	10	7	0	0	0	39
Sioux City	1	------	------	0	------	0	0	------	0	0	------
Waterloo	0	------	------	0	------	1	0	------	0	0	------
Missouri:											
Kansas City	0	------	0	8	8	24	0	6	0	4	130
St. Joseph	0	------	0	0	3	1	0	0	0	1	27
St. Louis	3	------	0	2	11	15	0	12	0	7	232
North Dakota:											
Fargo	0	------	0	1	1	0	1	0	0	0	14
Grand Forks	0	------	------	0	------	0	0	------	0	1	------
Minot	0	------	------	0	------	0	0	------	0	0	3
South Dakota:											
Aberdeen	0	------	------	0	------	2	0	------	0	0	------
Sioux Falls	0	------	0	0	0	1	0	0	0	0	8
Nebraska:											
Lincoln	0	------	------	1	------	2	0	------	0	0	------
Omaha	0	------	0	13	9	7	0	1	0	4	52
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	4
Topeka	0	------	0	2	2	1	0	0	0	0	10
Wichita	0	------	0	102	5	0	0	0	0	1	25
Delaware:											
Wilmington	0	------	0	0	6	5	0	2	0	10	35
Maryland:											
Baltimore	1	23	1	2	24	16	0	13	1	156	240
Cumberland	0	1	1	0	0	1	0	0	0	0	16
Frederick	0	------	0	0	1	0	0	0	0	0	5
District of Col.:											
Washington	3	3	2	0	10	16	0	15	0	7	155
Virginia:											
Lynchburg	0	------	0	1	1	4	0	0	0	2	14
Norfolk	0	7	0	6	5	2	0	1	0	1	24
Richmond	0	------	1	2	4	2	0	0	0	0	47
Roanoke	0	------	0	1	1	1	0	0	0	0	23
West Virginia:											
Charleston	0	4	0	0	1	0	0	1	0	0	18
Huntington	0	------	------	0	------	2	0	------	0	0	------
Wheeling	1	------	0	0	3	1	0	2	1	2	28
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	2	0	0	0	0	0	12
Wilmington	0	------	1	0	0	0	0	0	0	0	12
Winston-Salem	0	------	0	0	5	3	0	4	0	0	24
South Carolina:											
Charleston	0	28	0	0	0	1	0	0	0	1	14
Florence	0	------	0	0	3	0	0	0	0	0	15
Greenville	0	------	0	0	1	0	0	0	0	1	4
Georgia:											
Atlanta	0	12	1	10	8	4	0	5	0	1	78
Brunswick	0	------	0	0	0	0	0	0	0	0	5
Savannah	0	15	0	0	0	2	0	3	0	0	27
Florida:											
Miami	0	6	1	0	2	1	0	2	0	0	55
Tampa	2	1	1	80	1	1	0	0	0	3	34
Kentucky:											
Ashland	0	------	0	0	0	2	0	0	0	3	6
Covington	0	------	0	4	2	1	0	3	0	0	12
Lexington	0	------	0	0	0	5	0	0	0	1	19
Tennessee:											
Knoxville	0	------	0	0	1	11	0	0	0	0	28
Memphis	0	12	2	11	5	21	0	4	0	21	90
Nashville	0	5	0	3	1	1	0	0	0	0	56
Alabama:											
Birmingham	0	5	2	8	3	0	0	4	0	1	70
Mobile	0	3	0	0	0	0	0	0	0	0	22
Montgomery	1	3	------	11	------	0	0	------	0	0	------
Arkansas:											
Fort Smith	0	------	------	0	------	0	0	------	0	0	------
Little Rock	0	4	0	1	4	3	0	0	0	0	------
Louisiana:											
Lake Charles	0	------	0	1	1	0	0	0	1	0	6
New Orleans	2	5	0	11	11	17	0	13	0	24	139
Shreveport	0	------	1	1	12	0	0	4	0	0	67

City reports for week ended Mar. 30, 1940—Continued.

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Oklahoma:											
Oklahoma City	0		0	0	3	3	0	1	0	0	57
Tulsa	0			0		3	1		0	20	
Texas:											
Dallas	2	5	5	55	4	2	0	2	0	24	80
Galveston	0		0	1	2	1	0	1	0	0	14
Houston	0	1	2	10	7	3	0	8	1	5	79
San Antonio	1	4	2	47	6	0	0	9	0	1	73
Montana:											
Billings	0		0	0	1	0	0	0	0	0	7
Great Falls	0		0	1	0	2	0	0	0	0	7
Helena	0		0	0	0	0	0	0	1	0	3
Missoula	0		0	0	1	1	0	0	0	0	8
Idaho:											
Boise	0		0	1	0	0	0	0	0	0	9
Colorado:											
Colorado Springs	0		0	2	3	1	0	1	0	2	16
Denver	2		0	18	7	9	0	2	0	1	96
Pueblo	0		0	3	1	10	0	1	0	0	13
New Mexico:											
Albuquerque	0		0	1	0	1	0	2	0	8	13
Utah:											
Salt Lake City	0		0	166	2	1	0	0	0	51	32
Washington:											
Seattle	0		3	392	7	2	0	1	0	31	91
Spokane	0	1	1	4	3	4	0	1	0	8	37
Tacoma	0		0	9	0	0	0	0	0	0	34
Oregon:											
Portland	2	1	0	261	10	4	0	1	0	11	92
Salem	0			6		0	0		0	0	
California:											
Los Angeles	1	26	4	20	9	29	0	19	0	16	363
Sacramento	1		0	11	1	7	0	1	0	14	30
San Francisco	1	1	0	1	2	11	0	11	0	11	182

State and city	Meningococcus meningitis Cases	Meningococcus meningitis Deaths	Poliomyelitis cases
New York:			
Buffalo	1	0	0
New York	0	0	1
Ohio:			
Cleveland	0	1	0
Illinois:			
Chicago	2	1	0
District of Columbia:			
Washington	1	0	0
West Virginia:			
Huntington	1	1	0
Georgia:			
Savannah	1	0	0
Louisiana:			
Shreveport	0	1	0
Texas:			
Houston	3	0	0
Washington:			
Spokane	0	1	0
California:			
San Francisco	1	0	0

Dengue.—Cases: Charleston, S. C., 1.
Encephalitis, epidemic or lethargic.—Cases: New York, 2; Houston, 1; Great Falls, 1.
Pellagra.—Cases: Charleston, S. C., 1; Miami, 1.
Typhus fever.—Cases: New York, 1; New Orleans, 1; Houston, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Weeks ended March 16 and 23, 1940.—During the weeks ended March 16 and 23, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Week ended March 16, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1	2	1	2					6
Chickenpox		4	6	226	484	29	17	10	71	847
Diphtheria		1		25		2	3			31
Dysentery				4	3					7
Influenza		37	6		80	5			24	152
Measles		1		230	1,313	601	68	5	28	2,246
Mumps				75	438	9	17	2	8	549
Pneumonia					66	3	1		10	80
Scarlet fever		5	8	96	290	5	19	34	25	482
Trachoma					1				1	2
Tuberculosis	2	13	10	67	100	32		5		229
Typhoid and paratyphoid fever				26	2	2		2		32
Whooping cough		4		130	115	63	49	22	28	411

Week ended March 23, 1940

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				2	2		1			5
Chickenpox		12		210	309	36	32	1	30	630
Diphtheria			1	21	2		1			25
Dysentery				24						24
Influenza		32			40				91	103
Measles		12		213	373	561	131	3	59	1,352
Mumps				70	405	14	16	1	3	509
Pneumonia		6			24	2	2		11	45
Scarlet fever		6	7	90	159	8	11	12	12	305
Trachoma									7	7
Tuberculosis		3	10	56	22	3	28	1		123
Typhoid and paratyphoid fever			1	20	2	16		1	1	41
Whooping cough		12		138	97	40	31	2	17	337

NOTE.—No cases of the above diseases were reported from Prince Edward Island for the week ended Mar. 23, 1940.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of March 29, 1940, pages 567-571. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

Indochina (French).—During the period February 11-29, 1940, cholera was reported in French Indochina as follows; Louang Prabang, 7 cases, 3 deaths; Vientiane, 307 cases, 201 deaths.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Hamakua Mill Area.—A rat found on March 12 and another rat found on March 15, 1940, in Hamakua Mill Area, Hamakua District, Island of Hawaii, T. H., have been proved positive for plague.

Indochina (French)—Kandal.—During the period February 19-29, 1940, one case of plague was reported in Kandal, French Indochina.

Peru.—During the month of January 1940, plague was reported in Peru, by Departments, as follows: Lambayeque, 5 cases, 4 deaths; Libertad, 25 cases, 11 deaths; Lima, 11 cases, 9 deaths; Piura, 3 cases, 1 death.

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Public Health Reports

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IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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ADMINISTRATIVE FACTORS INVOLVING EFFECTIVENESS OF COMMUNICABLE DISEASE CONTROL

By E. A. LANE, M. D., *Director, Division of Communicable Diseases, Westchester County Department of Health, White Plains, N. Y.*

One of the important functions of a health department is its work in attempting to limit the spread of infectious diseases. To accomplish this purpose a public health nurse is usually sent to the home as soon as a case is reported, to instruct the family and to assist with arrangements for the isolation of the patient. Effective efforts at control are seldom made prior to the nurse's first visit.

It is doubtful whether the nurse's activities exert much effect on the spread in a community of certain of the communicable diseases, such as poliomyelitis and meningitis. Little or no pretense is made at control of measles, the primary object of the nurse's visits being to reduce mortality. For some of the other communicable diseases, however, such as diphtheria, scarlet fever, whooping cough, and typhoid fever, in which our knowledge of the etiology is more complete, it should be possible to effect a definite measure of control if our control measures could be instituted promptly at the onset of the illness, and provided that the nurse is able to secure intelligent cooperation from the members of the household.

Communicable disease control is admittedly imperfect, especially in diseases where there are large numbers of unrecognizable carriers and mild, missed cases. Since at best our efforts at control can only limit the number of cases of a disease occurring at any one time, in some cases merely postponing the attack, and cannot be expected to reduce the incidence to anything approaching zero, their effectiveness is difficult to evaluate. Such an evaluation will not be attempted here. It is assumed that such measures are of value and that their usefulness is impaired by the delay that usually occurs in carrying them out. This study was made to determine the magnitude of this delay and some of the reasons for it.

Communicable disease control, in the limited sense that includes only the activities undertaken to control the spread of infection from

the patient and his immediate environment, is, in the Westchester County Department of Health, the joint responsibility of the divisions of nursing and of communicable diseases. Reports of cases received by the latter which call for control measures are referred to the department nurses in the field. This is done by telephone for cases of diphtheria, dysentery, meningitis, ophthalmia neonatorum, paratyphoid fever, poliomyelitis, scarlet fever, and typhoid fever. For all other diseases notification is given by mail. Reporting by physicians to the health department is carried on in accordance with regulation 2 of chapter II of the State Sanitary Code which requires that every case shall be reported to the local health officer within 24 hours from the time the case is first seen. Nearly all case reports are received by mail.

The following material was obtained from the records for 1936. It does not include cases in the city of White Plains where physicians report mainly by telephone.

SOURCE OF MORBIDITY REPORTS

Approximately three-quarters of the case reports were received from physicians. The other reports were transmitted by public health, school, and visiting nurses for cases that were not attended by a private physician.

As would be expected, the more serious diseases were seen and reported by physicians in larger percentages than were the less serious diseases. The relatively high percentage of cases of German measles (rubella) reported by physicians is rather striking, especially since that disease reached epidemic proportions during the year covered by this study.

TABLE 1.—*Source of morbidity reports*

Disease	Cases reported	Percent reported by—	
		Physicians	Others
Chickenpox	1,352	39	61
Diphtheria	14	100	0
Rubella	2,867	86	14
Measles	3,239	71	29
Scarlet fever	486	100	0
Whooping cough	859	71	29
Total	8,817	73	27

INTERVAL BETWEEN DATE OF ONSET AND DATE OF PHYSICIAN'S FIRST VISIT

The interval between the date of onset of a disease and the physician's first visit would presumably be influenced by several factors, including the severity of the illness at the onset, the ability of the

family to pay a physician, and the duration of disability before the nature of the illness is suspected. Oddly enough, the seriousness of the disease, while it affected the percentage of cases in which medical attention was sought, as shown in table 1, did not appear to influence the promptness with which a physician was called. That is, if a physician was called, he was summoned about as promptly in a case of chickenpox as he was in a case of diphtheria or scarlet fever. The only exception to this is whooping cough, where the greater delay may have been due to the fact that for the first few days the illness appears to be nothing more than a common cold.

While improved economic conditions or a change in the manner of furnishing medical service might shorten this interval, it will never be obliterated and will always be more or less a hindrance to effective control of infection.

Because of the small numbers of cases involved, the data (table 2) for the less common and more serious diseases do not have much significance. In meningitis and poliomyelitis the interval between onset and physician's visit is of little moment, since a delay in calling a physician and in instituting control measures would probably have little or no effect on the incidence of the disease. In diphtheria, however, where the figures suggest that such a delay has occurred only too frequently, this time interval might be of considerable importance in the spread of the infection.

The other diseases listed show varying intervals, from chickenpox with 28 percent of the cases not seen by a physician until the third day of the illness or later to whooping cough with 82 percent in this category. In the latter disease a physician was not called in over half of the cases (55 percent) until the second week of the illness or later. Forty percent of both measles and scarlet fever patients were not seen by a doctor until after the second day of their illness.

If to the frequent delay in calling a physician is added the further obstacle that the physician, when called, may not always report the case promptly to the health department and that he may not always insure complete compliance with all of the necessary control measures on the part of the family, although charged by the State Sanitary Code with the responsibility for so doing pending the arrival of the health department representative, it can readily be appreciated why our control measures are not always as effective as they might be.

There were only two cases of typhoid fever in the group studied, one of which was first seen by a physician on the third day of the illness and the other not until the ninth day. In view of the vague, insidious character of the onset, delay in securing medical attention in this disease, while dangerous to the other members of the household, is readily understandable and occasional secondary cases will continue to occur.

TABLE 2.—*Interval between date of onset and date of physician's first visit*

Interval	Chicken-pox		Measles		Scarlet fever		Whooping cough		Diphtheria		Meningitis[1]		Poliomyelitis	
	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Per cent
Same day	85	37	328	30	90	28	20	14	6	55	4	66	2	40
1 day	80	35	327	30	102	32	5	4	1	9	1	17	2	40
2 days	21	9	218	20	54	17	6	4	1	9	0	------	0	------
3 days	16	7	102	9	32	10	5	4	2	18	0	------	1	20
4 days	8	4	62	6	12	4	8	6	1	9	1	17	0	------
5 days	6	3	16	2	12	4	6	4	0	------	0	------	0	------
6 days	5	2	12	1	8	3	12	9	0	------	0	------	0	------
7-13 days	6	3	18	2	6	2	42	30	0	------	0	------	0	------
14-20 days	0	------	2	(2)	0	------	27	19	0	------	0	------	0	------
21-27 days	0	------	0	------	0	------	9	6	0	------	0	------	0	------
Total	227	100	1,085	100	316	100	140	100	11	100	6	100	5	100

[1] Meningitis, meningococcus

[2] Less than ½ of 1 percent.

INTERVAL BETWEEN DATE OF PHYSICIAN'S FIRST VISIT AND DATE OF RECEIPT OF HIS REPORT

According to the State Sanitary Code (ch. II, regulation 2), a physician is expected to report cases of communicable diseases within 24 hours from the time he first sees the patient. From 12 to 24 hours would be required for the report to reach the health department by mail. There would, therefore, be a permissible interval of from 12 to 48 hours between the time of the physician's first visit and the time of receipt of the report at the health department. This interval might occasionally be longer should the physician experience difficulty in arriving at a diagnosis or desire to await the result of a laboratory examination before making his report. An upper limit of 48 hours would, however, be a generous allowance of time for receipt of the report in most cases. It will be observed in table 3 that the promptness of reporting, on this basis, was far from satisfactory. In the following percentages of cases the interval between date of physician's first visit and date of receipt of report was longer than 2 days: Whooping cough, 87 percent; meningococcus meningitis, 83 percent; poliomyelitis, 80 percent; diphtheria, 73 percent; measles, 66 percent; chickenpox, 63 percent; scarlet fever, 55 percent.

It should be remembered that in many cases the interval under consideration here would be in addition to that shown in table 2 and would thus serve to increase the time elapsing before the case came under the control of the health department.

Of the 2 cases of typhoid fever, one was reported on the fourth day and the other on the seventh day after the physician's first visit.

TABLE 3.—*Interval between date of physician's first visit and date of receipt of his report*

Interval	Chicken-pox		Measles		Scarlet fever		Whooping cough		Diphtheria		Meningitis [1]		Poliomyelitis	
	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent
Same day	18	8	79	7	25	7	1	1	1	9	1	17	0	------
1 day	24	10	138	12	50	15	5	3	1	9	0	------	1	20
2 days [2]	43	19	165	15	77	23	14	9	1	9	0	------	0	------
3 days	32	14	153	14	51	15	6	4	1	9	2	33	1	20
4 days	29	13	143	13	42	12.5	6	4	0	------	0	------	0	------
5 days	15	6	107	10	22	7	10	6	0	------	1	17	0	------
6 days	8	3	52	5	18	5	7	5	1	9	0	------	3	60
7-13 days	43	19	194	17	42	12.5	36	23	6	55	2	33	0	------
14-20 days	16	7	52	5	8	2	29	19	0	------	0	------	0	------
Over 3 weeks	3	1	29	2	2	1	40	26	0	------	0	------	0	------
Total	231	100	1,112	100	335	100	154	100	11	100	6	100	5	100

[1] Meningitis, meningococcus. [2] Maximum satisfactory interval.

INTERVAL BETWEEN DATE OF ONSET AND DATE OF HOSPITALIZATION

The percentages of reported cases hospitalized in 1936 is known for the following diseases: Diptheria, 58 percent; measles, 1 percent; scarlet fever, 23 percent; typhoid fever, 100 percent; whooping cough, 1 percent. The interval between onset and hospitalization has been tabulated (table 4) for all of these diseases except whooping cough, and also for meningococcus meningitis and poliomyelitis. The numbers of cases are very small except for measles and scarlet fever.

While hospitalization is ordinarily provided solely for the better care of the patient, it should, in diseases like diphtheria, scarlet fever, and typhoid fever, be of value in preventing the spread of infection if carried out early enough in the course of the illness and if a sufficiently large number of patients in homes ill suited for proper control are included. Poor facilities for medical and nursing care and for isolation and control are likely to go hand in hand, and such conditions often obtain in the presence of the more serious diseases for which efficient nursing service is desirable. Hospitalization, as well as other known control measures, probably has little or no effect upon the incidence of poliomyelitis and meningitis. As for measles and whooping cough, even if cases could be hospitalized in sufficiently large numbers, it is doubtful whether this procedure would have any appreciable effect on prevalence in view of the continued occurrence of unreported cases and the difficulty of securing sufficiently early knowledge of the reported cases. The purpose of hospitalization in these two diseases is now solely the care of the patient, either because home conditions are extremely unsatisfactory or because the case is unusually severe and the patient a poor risk.

The interval between date of onset and of hospitalization is affected, among other things, by the delay on the part of the family in summoning a physician (table 2), and it probably cannot be reduced to any great extent. Table 4 may indicate a satisfactory degree of promptness in hospitalizing the patient insofar as his medical and nursing care are concerned, but it does not indicate that any great degree of assistance may be expected from this measure in controlling the spread of infection in the community.

TABLE 4.—*Interval between date of onset and date of hospitalization*

Interval	Diphtheria	Measles	Scarlet fever	Meningitis[1]	Poliomyelitis	Typhoid fever
Same day	2	6	10	1	0	0
1 day	1	6	42	0	1	0
2 days	1	5	22	3	1	0
3 days	0	4	15	0	0	1
4 days	2	0	3	1	0	0
5 days	1	0	3	0	1	0
6 days	0	1	2	0	0	0
7-13 days	0	1	4	1	0	1
Total	7	23	101	6	3	2

[1] Meningitis, meningococcus.

INTERVAL BETWEEN DATE OF ONSET AND DATE OF NURSE'S FIRST VISIT

The interval between date of onset and date of the nurse's first visit very largely determines the effectiveness of our control measures. Unfortunately it is a composite interval that includes not only any delay that may occur from the time the case report is received until the nurse visits the home but also the delay on the part of the family in summoning a physician (table 2) and the further delay on the part of the physician in reporting the case (table 3).

Nurses are expected to make the first visit to cases of diseases that are reported by telephone as soon as possible and not later than 24 hours after the report is received. The initial visit to cases reported by mail, while made as soon as more urgent duties permit, must be made within 36 hours. Thus the longest permissible interval that should occur would be in the latter group of diseases when a case which was reported in the afternoon might not be visited until the second morning following. Nurses are expected to use discrimination in deferring visits, being guided in so doing by their knowledge of home conditions and whether or not a physician is known to be in attendance. That visiting is reasonably prompt is indicated by the fact that only 10 of 221 cases of those diseases that are reported by telephone were visited later than the day after the report was received. One hundred and ninety-five cases were visited the same day.

TABLE 5.—*Interval between date of onset and date of nurse's first visit*

Interval	Measles		Scarlet fever		Whooping cough		Diphtheria		Meningitis		Poliomyelitis	
	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases	Percent
Same day	108	5	7	2	6	2	1	9	0	-------	0	-------
1 day	167	8	52	13	2	0.5	0	-------	0	-------	0	-------
2 days	206	10	80	20	0	-------	2	18	0	-------	0	-------
3 days	193	9	79	20	7	2	2	18	2	33	1	20
4 days	225	10	61	15	2	0.5	3	28	0	-------	0	-------
5 days	225	10	43	10	5	1	2	18	1	17	1	20
6 days	182	9	30	7	8	2	0	-------	0	-------	2	40
7-13 days	658	31	42	10	77	19	1	9	3	50	1	20
14-20 days	137	6	7	2	93	23	-------	-------	-------	-------	-------	-------
21-27 days	30	1	3	1	71	18	-------	-------	-------	-------	-------	-------
Over 4 weeks	13	1	0	-------	125	32	-------	-------	-------	-------	-------	-------
Total	2,144	100	404	100	396	100	11	100	6	100	5	100

For the diseases that are reported by mail there is the further delay while the reports are in transit. Through timing a small sample of these reports it was found that the length of time in transit varied from ½ to 4 days, depending upon the destination, as follows:

Time in transit	*Number of reports*
½ day	5
1 day	21
1½ days	4
2 days	2
2½ days	3
4 days	2

The two reports that required 4 days to reach their destinations might well be excluded as exceptional cases since other reports sent to the same places were received within 1 or 2 days.

Of the 2 cases of typhoid fever, one was first visited by a department nurse on the tenth day of the illness and the other on the sixteenth day.

SUMMARY AND CONCLUSIONS

Tabular data are presented showing the delay that may occur under generally satisfactory public health conditions in instituting communicable disease control measures and some of the reasons therefor.

Even if communicable disease control measures were intrinsically more effective than they are, their effectiveness would be subject to very definite limitations owing to delays in putting them into effect.

It appears doubtful whether the delays due to the reasons above mentioned can be reduced appreciably under present conditions.

CEREBROSPINAL PATHOLOGY OF EXPERIMENTAL POLIOMYELITIS IN THE EASTERN COTTON RAT, *SIGMODON HISPIDUS HISPIDUS*, AND IN THE WHITE MOUSE, *MUS MUSCULUS*[1]

By R. D. Lillie, *Surgeon*, and Charles Armstrong, *Senior Surgeon, United States Public Health Service*

Since Armstrong's experimental propagation of the virus of poliomyelitis in the cotton rat (*1*) and in the white mouse (*2*), a histologic study of the brain and spinal cord lesions produced has been carried out. The findings on the first 31 cotton rats studied have already been reported (*3*), and the current report includes material from those animals together with material from 31 additional cotton rats, 1 gray mouse, and 35 white mice.

PATHOLOGY IN THE COTTON RAT

Data concerning inocula, passage generations, and anatomical diagnoses in the first 31 cotton rats have been published in a previous report (*3*). Table 1 presents these data for the 31 additional cotton rats considered in this study. Of the 62 animals, 7 have been excluded (*3*) (table 1), 2 are given special consideration as examples of chronic lesions, and the remainder are being considered as a group without reference to the fact that part of the material was previously reported.

Cord lesions were present in all but 4 of the 49 cotton rats in which spinal cord was saved for study. Often lesions were absent in one or more levels of the cord and present in others. Thus, the thoracic cord was reported as free of lesions in 10, the cervical in 7, and the lumbar in 5 of 27 cotton rats, while some cord involvement was present in all but 2. Uninvolved lumbar and thoracic levels were less frequent in animals dead 7 days or more after inoculation. Altogether, uninvolved levels were most frequent in the thoracic cord, least in the lumbosacral.

In about four-fifths of the animals a few, or sometimes many, small vessels in gray or white substance, often near the central canal, showed sheath lymphocyte infiltration or, less often, endothelial swelling and proliferation, or both. Perivascular glia proliferation was infrequent. In about two-thirds of the animals, coagulated necrotic nerve cells in the anterior horns were present in greater or less numbers. They presented strongly oxyphil cytoplasm and more or less completely karyolyzed nuclei. Often there was no evident cellular reaction about them. Frequently large vacuoles surrounded masses of oxyphil coagulated material, and the necrotic nerve cells apparently disappeared by a process of cytolysis, leaving no trace behind them.

[1] From the Divisions of Pathology and of Infectious Diseases, National Institute of Health.

Such necrotic cells have been seen as early as 3 days and as late as 26 days after inoculation, but are somewhat more frequent before the tenth day.

TABLE 1.—*Data concerning passage generations, source of inocula, survival periods, location and duration of paralysis, and anatomical diagnoses in 31 additional cotton rats experimentally infected with the virus of poliomyelitis*

Cotton rat No.	Pathology No.	Passage generation	Source of inoculum	Site of paralysis	Duration of paralysis, days	Day dead	Killed or died	Anatomical diagnosis	Remarks
49	16987	8	CR25	RF, RH, Atr.	171	180	D	Chronic poliomyelitis	Muscle atrophy.
323	16446	3	MR529	2F	2	12	K	Negative	
255	16440	12	CR269	+	2	6	D	Polioencephalomyelitis.	
321	16794	12	CR269	2F, RH	73	78	K	Chronic poliomyelitis	
338	16451	14	CR214	2F, 2H, LN	5	10	K	Polioencephalomyelitis.	
325	16523	14	CR214	2F	2	12	D	do	
349	16850	14	CR214	0	0	88	D	Negative	Excluded.
386	16524	15	CR337	2F	1	7	D	Acute poliomyelitis	
398	16529	15	CR329	0	0	7	D	Polioencephalomyelitis.	
387	16556	15	CR329	2F, 2H	6	13	K	do	
295	16531	15M1	MM1	2F	1	6	K	Polioencephalitis	
394	16558	16	CR373	2F, 2H, J	2	9	K	Polioencephalomyelitis.	
365	16567	16	CR177	2F, 2H	4	12	K	do	
353	16468	M2	MMP2:1	2F, LH	4	10	K	Slight polioencephalitis	No cord.
400	16559	17	CR280	2F	1	3	D	Acute poliomyelitis	
290	16553	M3	MMP3:4	RF	1	7	K	Acute polioencephalomyelitis.	
356	16591	19	CR278, 389	+	1	8	D	Early acute poliomyelitis.	
281	16611	19	CR278, 389	+	1	4	D	Acute poliomyelitis	
302	16612	19	CR278, 389	+	1	4	D	Acute polioencephalomyelitis.	
336	16613	19	CR278, 389	Complete	4	7	K	Polioencephalomyelitis.	
377	16644	19	CR278, 389	Complete	4	14	K	do	
445	16646	20	CR433	+	1	7	K	do	
464	16708	M11	MMP27:1:2	+	1	4	D	Acute poliomyelitis	
501	16758	M13	MMP34:2	2F	2	5	D	Polioencephalomyelitis.	
319	16863	32	CR529	+	4	4	K	do	Second inoculation.
332	16864	32	CR529	+R	1	4	K	Acute polioencephalomyelitis.	
207	16869	32	CR529	+	1	6	K	Polioencephalomyelitis.	
573	17097	M19	MMP50:12	2F, 2H	2	6	K	Poliomyelitis	
575	17154	36	CR570	Rolling	2	5	D	Acute poliomyelitis	
581	17228	37	CR574	+	1	6	D	do	
563	16988	38	CR559	R	1	2	K	Negative	

R=right, L=left, F=foreleg, H=hind leg, R=respiration, N=neck, B=back, +=present, 0=none noted.

Often one or more polymorphonuclear leucocytes were seen invading the necrotic nerve cells, but the accumulation of a ring of leucocytes about the necrotic cell was infrequent in this species. A diffuse irregular polymorphonuclear leucocyte infiltration of the gray substance of the anterior horns occurred as early as 3 days after inoculation, was present in over two-thirds of the rats from the fifth to the ninth day, and was infrequent thereafter. Cellular gliosis appeared in nodular and diffuse form at about the fifth day and was somewhat more frequent and greater in amount after the tenth day. Neuronophagia by macrophages was late and relatively infrequent. Massive replacement of the anterior horn by monocytes or foamy macrophages

was present in 3 cotton rats in one (lumbar) level of the cord, and in these areas there were no remaining surviving nerve cells.

The cerebral reaction was later in appearing than that in the spinal cord, in spite of the intracerebral route of inoculation used in all animals, and appeared sooner in the pons and medulla than anteriorly (table 2). Several animals dead in the first 4 days after inoculation showed well marked cord lesions in one or more levels and minimal or no cerebral reaction. The amount and frequency of the reaction diminished in the brain stem from the pons forward. In the cerebral cortex, focal lesions were most frequently present in the frontal area, but still few in number. The cerebellar and occipital cortex least often showed focal lesions (table 3).

TABLE 2.—*Number of cotton rats showing brain and cord lesions in relation to time*

Days	Reaction	Frontal	Parietal	Temporal	Occipital	Hippocampus	Corpus striatum	Thalamus	Midbrain	Pons	Cerebellar nucleus	Cerebellar cortex	Medulla	Cord
2-4	+	1	1	0	0	2	0	1	2	4	2	2	3	7
	−	7	7	8	8	6	8	7	6	4	4	6	4	1
5-7	+	11	6	5	4	11	6	14	19	20	3	6	14	17
	−	9	13	14	11	8	14	5	0	0	13	13	0	2
8-10	+	7	6	5	0	4	4	8	8	10	3	3	9	9
	−	3	4	5	4	6	6	2	2	0	2	7	0	0
11-14	+	8	3	6	4	7	5	6	7	8	4	2	5	8
	−	2	7	4	4	3	5	4	3	2	4	8	2	1
15-26	+	3	1	0	2	3	2	2	4	4	5	0	3	4
	−	2	4	5	3	2	3	3	0	0	0	5	0	6

TABLE 3.—*Number of cotton rats showing various grades of reaction in various parts of the brain*

Reaction	Frontal	Parietal	Temporal	Occipital	Hippocampus	Corpus striatum	Thalamus	Midbrain	Pons	Cerebellar nucleus	Cerebellar cortex	Medulla	Spinal cord
−	23	35	36	30	25	36	21	11	6	13	39	6	4
±	23	11	10	4	13	14	22	17	15	13	11	17	19
+	4	3	3	4	10	2	8	19	27	14	2	15	18
++	3	3	3	2	4	1	1	5	4	0	0	2	8
Total	53	52	52	40	52	53	52	52	52	40	52	40	49

Cerebral cortical lesions were usually vascular, consisting chiefly of vessel sheath lymphocyte infiltration. Few foci of cellular gliosis were seen. Nerve cell necrosis in the hippocampus was seen in 7 cotton rats and was usually accompanied by a more or less diffuse cellular gliosis, with some polymorphonuclear leucocyte infiltration in one animal.

The corpora striata and thalamus showed chiefly vascular lesions, nodular glia foci remaining infrequent even in the thalamus.

Focal and diffuse cellular gliosis was more frequent in the midbrain, especially in the tegmental area and substantia nigra. Isolated necrotic nerve cells were seen in 13 cotton rats, situated usually in red nuclei and tegmentum, sometimes in the substantia nigra or oculomotor nuclei. Neuronophagia by macrophages was occasionally seen, but polymorphonuclear exudation was not observed.

In the pons, reactions were more frequent and more marked than in any other part of the brain. The tegmentum and trigeminus nuclei showed the most involvement, including much diffuse and focal cellular gliosis and frequent necrotic nerve cells. Nerve cell necrosis was noted in about half of the animals, but definite neuronophagia and polymorphonuclear exudation were infrequent.

The cerebellar roof nuclei presented vascular lesions and focal and diffuse cellular gliosis in about two-thirds of the animals, and isolated necrotic nerve cells were noted in 4 cotton rats. The mesial or tectal nuclei were apparently more involved than the lateral or dentate, as in man and monkeys. The cerebellar cortex presented infrequent vascular lesions and occasional glia nodes, the latter usually in the molecular layer.

In the medulla also there were many vascular lesions and much focal and diffuse cellular gliosis, particularly in the reticular gray substance. Necrotic nerve cells were noted in 15 of 40 cotton rats, occurring chiefly in the reticular substance, occasionally in other nuclei.

Meninges commonly showed diffuse and perivascular infiltration in which lymphocytes predominated.

In addition to the 53 cotton rats considered in the foregoing description, studies were made in 2 rats which survived 78 and 180 days with paralyses in both cases of the right fore and right hind legs which had lasted 73 and 171 days, respectively. These animals showed no evident brain lesions in any area. In both, the anterior horns of lower cervical and lumbosacral levels showed reduction in number of nerve cells and slight spindle cell gliosis, more marked on one side, with normal or less reduced cell content on the other.

Muscle from the atrophic foreleg of one of these cotton rats showed some normal muscle bundles and other bundles of muscle fibers of less than half the normal width and a greatly increased number of nuclei.

PATHOLOGY IN THE WHITE MOUSE

During the period from November 1, 1939, to March 1, 1940, central nervous systems of 36 mice inoculated with poliomyelitis virus were studied. Data regarding survival periods, presence, duration and location of paralyses, virus transfers and anatomical diagnoses are

recorded in table 4. During the same period brains from some 130 mice were sectioned and studied in connection with lymphocytic choriomeningitis, typhus, and spotted fever studies Pictures corresponding to that about to be described were not encountered in this other material.

Cord lesions were present in 21 of the 23 mice in which sections of spinal cord were taken for study. Lesions were present in the cervical levels in 18 of 23 mice, in thoracic levels in 6 of 21 mice, and in lumbosacral cord in 12 of 21 mice. They were confined to one level in 9 mice and to two in 4

Cord lesions appeared as early as 2 days after inoculation Two and 3 days after inoculation they were present in 4 of the 5 mice in which spinal cord sections were made. In this period cerebral lesions were absent (4 mice) or infrequent (7 mice) in spite of the intracerebral inoculation (table 5). Four to 7 days after inoculation lesions were present in 7 of the 8 spinal cords studied. Brain stem lesions were present and often numerous in 11 of the 12 mice, cerebral cortical lesions were still infrequent, absent in 4, few in 4, and moderately frequent in 4 mice. In the 10 mice surviving to the tenth day or longer, brain stem lesions were constantly present and often numerous, cortical lesions were present in 9 and moderately frequent in 3, and cord lesions were more often confined to a single level (6 mice) or two levels (2 mice).

Coagulation necrosis of nerve cells in the anterior horns of the spinal cord was present in all 3 of the mice dying 2 days after inoculation, and in 1 of the 2 spinal cords examined in mice dead 3 days after inoculation. It was accompanied by vacuolation of some of the remaining nerve cells, tigrolysis, more or less focal or diffuse cellular gliosis, and vessel sheath lymphocyte infiltration or vascular endothelial swelling and proliferation. Polymorphonuclear leucocyte infiltration was present in some sections, but not all, and invasion of necrotic nerve cells was seen in one mouse.

In the 4- to 7-day period vascular lesions and cellular gliosis became more prominent, nerve cell necrosis was usually demonstrable, polymorphonuclear infiltration was seen in 1 of the 8 cords studied, and neuronophagia by macrophages was sometimes clearly evident.

The 10 mice dead 10 to 95 days after inoculation showed generally more pronounced cellular gliosis with small clumps sometimes suggesting previous neuronophagia, generally moderate or marked vessel sheath lymphocyte infiltration, sometimes definite macrophage neuronophagia, inconstantly a few coagulated necrotic nerve cells, no polymorphonuclear leucocytes, and often an evident reduction in number of nerve cells. The last is particularly striking when unilateral.

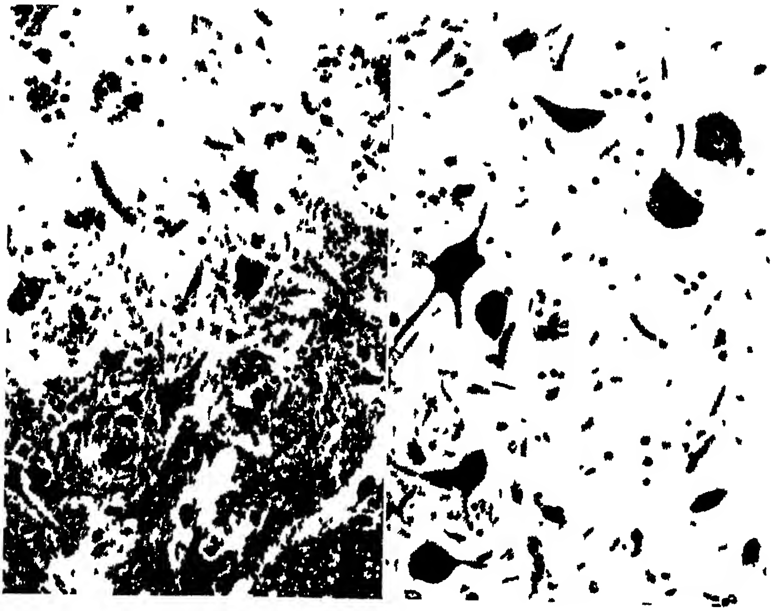

FIGURE 1—Cotton rat 16559, 3 days Contralateral anterior horns in same level of spinal cord Left, necrosis and polymorphonuclear invasion of nerve cells, right, normal (× 200)

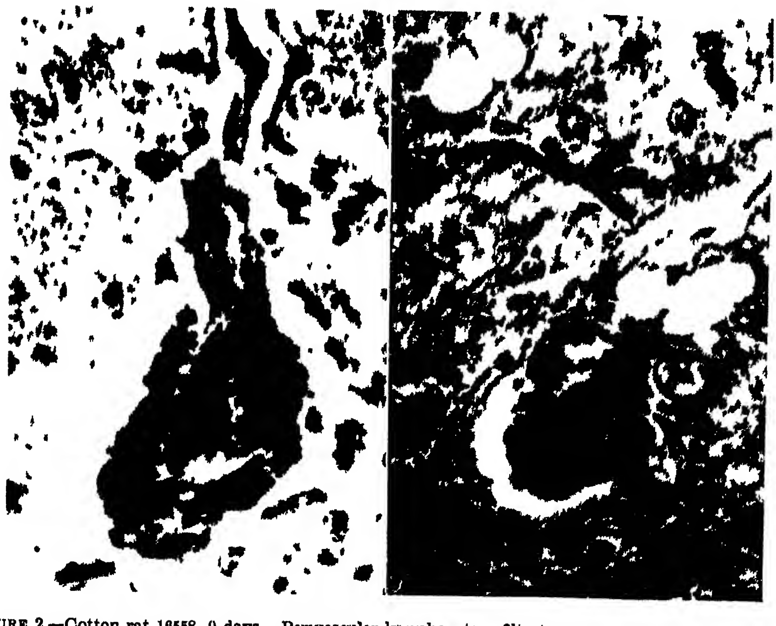

FIGURE 2—Cotton rat 16558, 9 days Perivascular lymphocyte infiltration in tegmentum of pons (left) and cerebellar roof nuclei (right) (× 400)

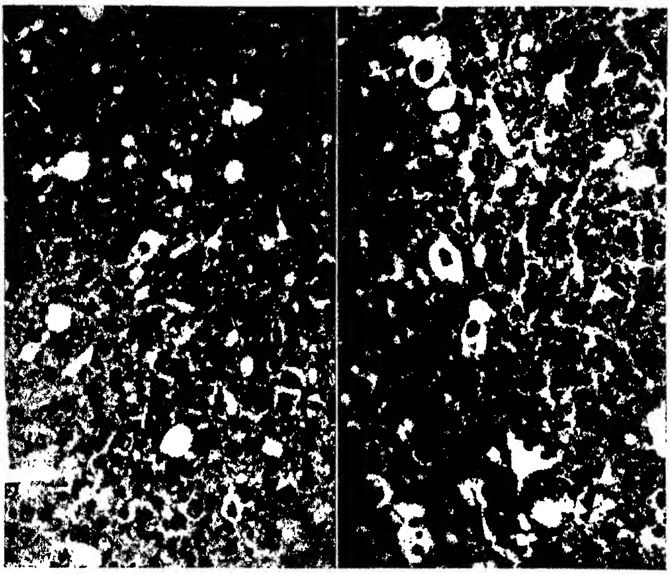

FIGURE 3.—Cotton rat 16556, 13 days. Diffuse foam cell gliosis of anterior horns of spinal cord with nerve cell destruction and (right) remains of necrotic cells in large vacuoles. (X 200)

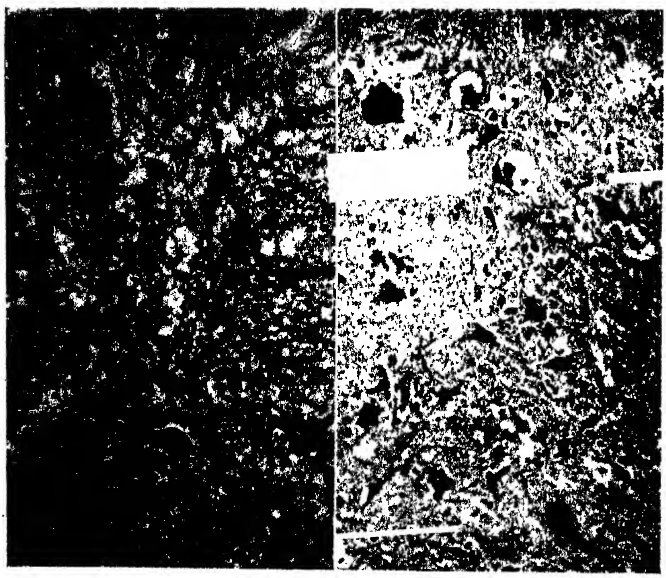

FIGURE 4.—Cotton rat 16987, 180 days. Cell decrease, paralyzed side (left) compared with nonparalytic side (right), anterior horns of spinal cord in same level. (X 200)

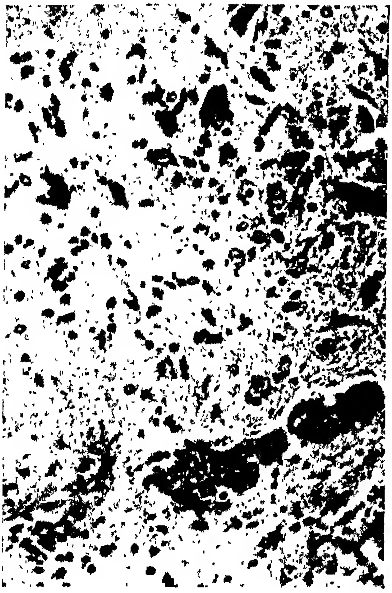

FIGURE 5.—Mouse 16561, 5 days. Anterior horn of spinal cord, vascular lesion and focal gliosis. (X 200)

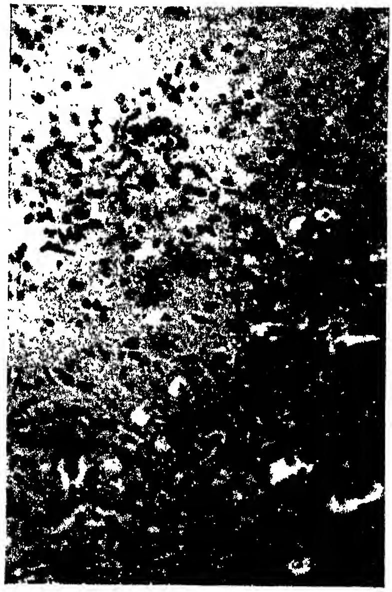

FIGURE 6.—Gray mouse 17046, 6 days. Anterior horn of spinal cord, rod cell gliosis and probable neuronophagia. (X 200)

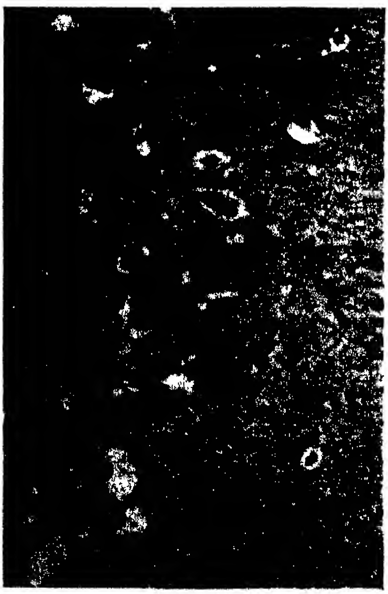

FIGURE 7.—Mouse 17247, 6 days. Nerve cell necrosis, anterior horn of spinal cord. (X 200)

FIGURE 8.—Mouse 16737, 12 days. Anterior horn of spinal cord, normal nerve cells, slight perivascular lymphocyte infiltration. (X 200)

FIGURE 9.—Mouse 17247, 6 days. Pons, fifth nucleus, destruction of nerve cells, cellular gliosis, perivascular lymphocyte infiltration (× 200)

FIGURE 10.—Mouse 16695, 19 days. Pons, fift nucleus, cell decrease, gliosis, and vascula lesions (× 200)

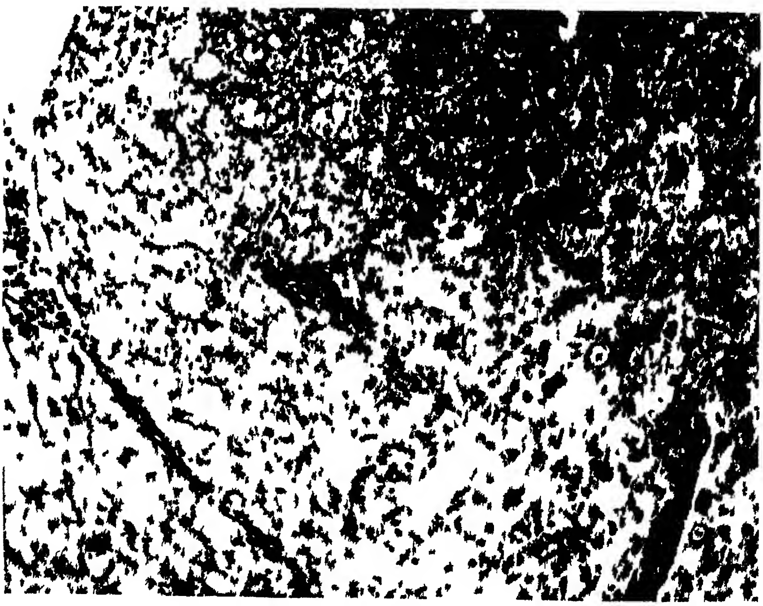

FIGURE 11.—Mouse 16695, 19 days. Cervical cord, gliosis, vascular lesions, meningeal infiltration. (× 200)

TABLE 4.—*Data concerning passage generation in mice, source of inoculum, survival period, location and duration of paralysis, and anatomical diagnoses in poliomyelitis in mice*

Mouse No.	Pathology No	Passage generation	Source of inoculum	Site of paralysis	Duration of paralysis, days	Day dead	Killed or died	Anatomical diagnosis	Remarks
SX2 4·2	16561	1	337–5M1	0	0	5	D	Poliomyelitis, probable	
Ex329–4	16608	1	CR329	LF, 2H	2	23	K	Acute polioencephalomyelitis	
ExCr559 1	16986	1	CR559	+	1	2	K	Dubious slight encephalitis	Bacterial infection, excluded
ExCR559 2	16985	1	CR559	+	1	2	K	Encephalitis	
P54–5	17148	1	CR568	2F, 2H	1	7	K	Polioencephalomyelitis	
ExCR405 5	17173	1	CR405	2F, R	1	95	D	Acute polioencephalomyelitis	
M2–A1	16436	2	M1	2F, R	1	3	D	Indefinite	No cord
M2–A2	16435	2	M1	2F, R	1	3	D	Indefinite	Do
P1:2	16560	2	CR337–M2	RF, 2H	2	6	D	Indefinite	Do.
Sx1·P4·14	16562	2	CR337–M2	+	1	6	D	Dubious, slight encephalitis	Do.
P3·M3.9	16450	3	M2 1	2F, R	1	5	D	Polioencephalomyelitis	
M3.10	16467	3	M2 1	2F, R	1	7	D	Polioencephalitis	
P14M6.2	16597	6	P12 M5 405	2F, R	1	3	K	Acute poliomyelitis	
Sx11 1·1	16642	7	P18 9	2F	1	3	D	Indefinite	Do
Sx11 1 2	16643	7	P18 9	+	1	3	D	Negative	Do
Sx15 15 1	16641	7	P18 9	0	0	3	D	Negative	Do
Sx15 15·2	16640	7	P18·9	0	0	3	D	Negative	Do
Sx15 15	16738	7	P18 9	RF	......	23	K	Poliomyelitis	
P22 1	16650	9	P19–M8	0	0	4	D	Polioencephalitis	Do
P22.2	16651	9	P19–M8	0	0	4	D	Polioencephalitis	Do.
P19.1P	16695	9	M8–4	LF, B	1	19	K	Polioencephalomyelitis	
P19 10V	16696	9	M8–4	2F, N, B, R	2	19	K	Polioencephalomyelitis	
P22 10	16736	9	P19–M8	2F, 2H, R	1	20	K	Polioencephalomyelitis	
P27 6V	16737	10	P22–4	RF	2	12	K	Polioencephalomyelitis	
P29.1	16697	10	P22–5 6	RF	1	3	K	Dubious, slight encephalitis	
P30 3 3.M	16757	12	P27–2 3	2F, 2H	1	17	K	Poliomyelitis	
P35 1	16762	14	P34 2	2H	1	6	K	Acute polioencephalitis	
P40.10	17004	16	P38 9	LF, 2H	1	13	D	Purulent meningoependymitis	Excluded
P48 5	17045	19	P46 3	2F	1	15	K	Polioencephalomyelitis	
P50·11	16989	19	P48 10	RH	1	7	K	Acute poliomyelitis	
P51 4	17046	19	P49 3	2F, 2H	1	6	K	Acute polioencephalomyelitis	Gray mouse.
P53·10	17099	20	P50 10	2H	2	10	K	Polioencephalomyelitis	
P65.2	17247	21	P59 6	2F, 2H, R	2	6	K	Acute polioencephalomyelitis	
P63.13	17185	21	P65 4	0	0	2	D	Acute poliomyelitis	
P64·2	17186	21	P65 4	0	0	2	D	Acute poliomyelitis	
P64.7	17189	21	P65 4	0	0	2	D	Probably early poliomyelitis	

R=right, L=left, F=foreleg, H=hind leg, R=respiration, N=neck, B=back, +=present, 0=none noted

TABLE 5.—*Numbers of mice showing various grades of reaction in the various parts of the brain and cord by time periods*

	Reaction	Cerebral cortex 4 levels	Hippocampus	Corpus striatum	Thalamus	Midbrain	Pons	Cerebellar nuclei	Cerebellar cortex	Medulla	Cervical cord	Thoracic cord	Lumbar cord
2-3 days, 11 mice	−	38	9	11	8	10	8	8	11	9	2	4	2
	±	4	1	0	2	1	1	1	0	0	2	0	1
	+	0	1	0	1	0	1	0	0	1	1	1	2
	++	0	0	0	0	0	0	0	0	0	0	0	0
	0	2	0	0	0	0	1	2	0	1	6	6	6
4-7 days, 12 mice	−	27	7	11	6	1	2	6	9	1	2	3	2
	±	13	0	1	4	3	1	2	2	3	1	3	0
	+	5	3	0	2	4	3	1	0	4	4	1	2
	++	0	2	0	0	3	5	0	0	4	1	0	3
	0	3	0	0	0	1	1	3	1	0	4	5	5
Over 7 days, 10 mice	+	22	3	7	3	0	0	6	9	0	1	8	5
	±	9	3	3	6	3	3	2	0	1	0	1	1
	+	6	4	0	1	5	2	0	1	6	7	0	2
	++	2	0	0	0	1	5	1	0	2	2	0	1
	0	1	0	0	0	1	0	1	0	1	0	1	1
All 33 mice	−	87	19	29	17	11	10	20	29	10	5	15	9
	±	26	4	4	12	7	5	5	2	4	3	4	2
	+	11	8	0	4	9	6	1	1	11	12	2	6
	++	2	2	0	0	4	10	1	0	6	3	0	4
	0	6	0	0	0	2	2	6	1	2	10	12	12

−=negative, ±=slight, +=moderate, ++=marked, 0=missing.

Lesions appeared in the medulla at about the fourth day and were almost regularly present thereafter. Vascular lesions were prominent, and focal and diffuse cellular gliosis was frequent. The reticular substance, seventh, ninth, tenth, and ambiguus nuclei were noted as especially involved in some animals. Coagulated necrotic cells were seen in 3 mice, but neither definite neuronophagia nor polymorphonuclear infiltration were recorded.

In the pons lesions appeared about the same time, were of similar types, and were generally somewhat more frequent and marked than in the medulla. Sites of predilection are tegmentum and trigeminus nuclei, though restriction to these areas is less definite than in cotton rats and monkeys. Coagulated necrotic nerve cells were noted in 8 mice, definite neuronophagia in 2, but the presence of polymorphonuclear leucocytes was not recorded.

Seven mice presented few to moderate numbers of vascular lesions and focal and diffuse cellular glioses in the central cerebellar nuclei. In one, diffuse gliosis was quite marked in the mesial or tectal portion. Occasional perivascular lymphocyte infiltration was noted in the cerebellar cortex.

The midbrain presented fewer lesions, but similar to those in the pons. Appreciably marked reactions were later in appearance, about the sixth day. Tegmental areas, substantia nigra, and red and third nuclei were particularly involved. Necrotic nerve cells were seen in

4 mice, accompanying neuronophagia and polymorphonuclear infiltration in 1 each.

Thalamic lesions were few, usually focal glioses or vascular lesions, and were infrequent before the seventh day. Focal lesions in the corpora striata were of the same types, absent before the seventh day and infrequent thereafter.

Cerebral cortical lesions consisted of perivascular lymphocyte infiltration, vascular endothelial swelling and proliferation, patches of diffuse cellular gliosis, often of rod cells and fewer small nodular and perivascular glioses. They showed definitely greater frequency in the hippocampus and were here occasionally accompanied by necrotic nerve cells. The other cortical areas, frontal, parietal, temporal, and occipital showed fewer lesions in fewer mice.

The leptomeninges commonly showed some infiltration by lymphocytes, slight up to the sixth day, somewhat more marked thereafter. Sections of chorioid plexus were noted in 91 locations in 28 mice. Slight lymphocyte infiltration was noted in 6 of these locations in 5 mice.

SUMMARY

Intracerebral inoculation with the Lansing strain of poliomyelitis virus produces in cotton rats (*Sigmodon hispidus hispidus*) and white mice (*Mus musculus*) an inflammatory process characterized by necrosis of nerve cells, polymorphonuclear leucocyte exudation and invasion of necrotic cells, neuronophagia by macrophages, diffuse and focal cellular gliosis, vascular endotheliosis and sheath lymphocyte infiltration. In the brain the dorsal portion of the pons shows the greatest involvement, then medulla, midbrain, thalamus and cerebellar roof nuclei. Cerebral cortex in both species shows relatively little involvement, most in the hippocampus. Corpora striata and cerebellar cortex show the least involvement. In spite of intracerebral inoculation into the thalamomesencephalic region, the earliest observed lesions are found in the spinal cord in both species.

The process in both species is considered closely similar to the reaction of poliomyelitis in man and monkeys. In general, the amount of vessel sheath lymphocyte infiltration is less in cotton rats than in mice, monkeys, or man.

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(*2*) Armstrong, C.: Successful transfer of the Lansing strain of poliomyelitis virus from the cotton rat to the white mouse. Pub. Health Rep., **54**: 2302 (1939).

(*3*) Lillie, R. D., and Armstrong, C.: The pathology of poliomyelitis experimentally induced in the eastern cotton rat, *Sigmodon hispidus hispidus*. Pub. Health Rep., **55**: 115 (1940).

A NOTE ON THE PATHOLOGY IN MONKEYS OF THE LANSING STRAIN OF POLIOMYELITIS VIRUS BEFORE AND AFTER PASSAGE IN THE COTTON RAT [1]

By JAMES H. PEERS, *Research Associate, United States Public Health Service*

Last autumn Armstrong (*1*) reported the successful transfer of a strain of poliomyelitis virus from the monkey to the eastern cotton rat. Subsequently, Lillie and Armstrong (*2*) described and illustrated the lesions produced in the cotton rat by this virus. In the interval the virus has been propagated through more than 45 serial rat passages. Material was reinoculated into monkeys from the third, sixth, fifteenth, and thirty-third rat transfer in order to confirm the identity of the virus. Previous to establishing the strain in rats, it had been maintained by passage through 15 monkeys, in 11 of which pathological examination was made. By a comparison of lesions in the 11 monkeys before rat transfer with those of the 4 after transfer, it is possible to gage the effect on the virus of a fairly prolonged sojourn in a new and very different animal host.

The "Lansing" strain of poliomyelitis virus was originally obtained from a portion of the spinal cord of a 16-year-old boy who died of bulbar poliomyelitis during a small outbreak in Lansing, Mich., in the summer of 1937. Unfortunately we have not had the opportunity of examining the brain from this patient, so we have no exact knowledge of the character and distribution of the original human lesions. Judged by pathologic standards, this strain of virus is highly virulent, for the brain stem lesions in monkeys are somewhat more widespread and severe than those usually obtained with other strains in this laboratory.

From examination of the brains of the 11 monkeys in which the Lansing strain had been carried before rat transfer, it is possible to construct a composite pattern of the lesions produced by this virus. All brains regularly showed maximum inflammatory infiltration with more or less necrosis of nerve cells in the red nucleus, the substantia nigra, the reticular substance of the tegmentum of pons and medulla, and the tectal and dentate nuclei of the cerebellum. Lesions somewhat less constant and severe appeared in the nuclei of the trigeminal, abducens, facial, and vestibular portion of the eighth nerve, and the nuclei of the funiculi gracilis and cuneatus. The nuclei of the oculomotor, trochlear, vagus, and hypoglossal nerves generally escaped or presented only minimal lesions.

The lesions in the basal ganglia were more difficult to evaluate because of the presence there of an often large area of nonspecific necrosis and reaction caused by the intracerebral inoculation. After this had been discounted, there appeared quite constantly scattered

[1] From the Division of Pathology, National Institute of Health.

microglial foci in the thalamus and hypothalamus, a few in the globus pallidus, and rare lesions in the putamen. Lesions almost never appeared in the caudate nucleus. Definite changes were observed only once in the olfactory bulbs. In a few animals there were one or two scanty perivascular infiltrations in the olfactory tubercles and hippocampus.

The majority of brains presented sparse lesions in the cerebral cortex, generally confined to the motor portion of the frontal lobes. The lesions consisted of small foci of microglia, and rarely neuronophagia of a single nerve cell. Similar microglial foci were more constantly present in the molecular layer of the vermis cerebelli.

More or less marked round cell infiltration of the meninges and chorioid plexus was seen in occasional animals throughout the series. This bore no apparent relation to the source of the inoculum or to the severity of the parenchymatous damage.

After successful transfer and propagation of this strain of virus in cotton rats, material from the third, sixth, fifteenth, and thirty-third consecutive rat passages was again transferred to monkeys by intracerebral inoculation. All 4 animals developed symptoms of severe poliomyelitis in an average of 7 days, and were killed to obtain tissue for study. Pathologic examination of their brains furnished comparable data from which to estimate any modification of pathogenicity for monkeys of the Lansing strain of virus caused by prolonged rat passage. The lesions observed varied only slightly in severity in the 4 monkeys, and their type and distribution corresponded exactly to that characteristic of the strain before rat passage. The pathologic picture in the first and last monkey was practically identical, though 30 generations of rat passage of the virus intervened between them.

CONCLUSION

The lesions produced in 11 monkeys by the Lansing strain of poliomyelitis virus before transfer to the cotton rat have been briefly described. After transfer and during its propagation in rats the virus has been reinoculated into 4 monkeys. In these it produced uniform lesions morphologically indistinguishable from those observed before rat passage. It therefore appears that neither the initial transfer nor the subsequent passage through 33 cotton rats visibly modified the pathogenic properties of this strain of poliomyelitis virus.

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(2) Lillie, R. D., and Armstrong, Charles: The pathology of poliomyelitis experimentally induced in the eastern cotton rat, *Sigmodon hispidus hispidus*. Pub. Health Rep., 55: 115–119 (1940).

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A HIGHLY VIRULENT STRAIN OF ROCKY MOUNTAIN SPOTTED FEVER VIRUS ISOLATED IN THE EASTERN UNITED STATES [1]

By NORMAN H. TOPPING, *Passed Assistant Surgeon*, and R. E. DYER, *Senior Surgeon, United States Public Health Service*

In 1931 Badger, Dyer, and Rumreich (*1*) reported the isolation and identification in the eastern part of the United States of an infection of the Rocky Mountain spotted fever type. Three strains of the infection were isolated from 3 cases of the disease. Two of these strains were carefully studied and identified. Of a total of 617 guinea pigs used in this study they reported a fatality of 25 percent and the appearance of scrotal lesions in only 1 of the guinea pigs.

Including these 2 strains of Rocky Mountain spotted fever reported by the above authors, a total of 13 strains have been isolated from cases occurring in the eastern part of the United States and have been studied over varying periods of time. Five of these 13 strains have been carried in the laboratory for a year or longer. In 12 of them the fatality rate has been between 7 and 40 percent; only 2 have exhibited scrotal lesions in the guinea pigs and then only rarely and with great inconsistency. The other strain of Rocky Mountain spotted fever isolated in the summer of 1939 and hereafter called the "W" strain has differed rather markedly from the usual strains isolated in the eastern United States. The purpose of this paper is to report in some detail the reaction in guinea pigs of this strain of the infection as compared to a known virulent western strain and a freshly isolated strain which has been representative of the usual strains in the East.

The differences between the various strains of infection may be shown by comparisons in fatality rates, incubation periods, and the presence or absence of involvement of the scrotum. With a strain recovered in Montana and highly virulent for guinea pigs, only about 50 percent of the guinea pigs inoculated develop the scrotal lesions; the others usually die before sufficient time has elapsed for the lesions to develop, or the lesions occasionally fail to appear for some unknown reason. The first appearance of the scrotal reaction is usually noted somewhere between the fourth and seventh day of fever. The scrotal reaction is initiated by a very slight diffuse erythema and at this stage the skin of the scrotum becomes stretched and assumes a shiny appearance. The following day a macular rash is seen over the scrotum and may extend upward onto the groin. These macules become darker very rapidly so that within 24 hours the skin of the scrotum appears purpuric where the dark purplish macules have coalesced. The superficial layers of the skin then begin to become necrotic and crusts are found over the purpuric lesions. These hard

[1] From the Division of Infectious Diseases, National Institute of Health.

crusts are easily palpated on the scrotal skin. The crusts and the superficial layers of the skin slough leaving ulcers which may have more or less bizarre shapes. Before the slough is complete healing begins, both from the bottom of the ulcer and from the edges where the epithelium may become somewhat "piled up." Healing is usually complete in 5 to 7 days and leaves a permanent scar or scars on the scrotum. The whole process has been confined to the skin proper and at no time have the deeper layers or structures in the scrotum been involved macroscopically.

Seven strains of Rocky Mountain spotted fever were isolated from patients in and around Washington during the season of 1939. One of these strains ("W") after the eighth passage through guinea pigs began to exhibit the typical scrotal lesions just described and commonly seen in strains which have been isolated in the West and studied in guinea pigs. This is the first strain isolated in the East that has shown these scrotal lesions with any degree of consistency. The incubation period in this strain has been shorter than the other strains, and the guinea pig fatality rates have been much higher. Using these three criteria (i. e., scrotal lesions, incubation period, and fatality rate) as the comparative points, this one strain ("W") is almost identical with our stock strain of Rocky Mountain spotted fever ("B. R.") isolated in the Bitterroot Valley in Montana. The data on these two strains, plus a third strain ("M") which also was isolated in the East, are summarized in table 1.

TABLE 1

Strain	Isolated in—	Number of guinea pigs	Number died	Number recovered	Percent fatality
B. R.	Montana	50	41	9	82
W	Washington, D. C.	22	19	3	86
M	do	41	14	27	34

The figures in this table show the results of the routine passage of the strains in 500-gm. male guinea pigs inoculated with 2 cc. of whole blood drawn from an infected guinea pig on about the second day of fever. The data were assembled for exactly comparable seasons of the year. The "B. R." strain has been carried for several years as our type strain of Rocky Mountain spotted fever. Complete cross immunity exists between it and the "W" and "M" strains, as well as between the "W" and "M" strains themselves. No cross immunity exists between any of these three strains and endemic typhus, epidemic typhus, or "Q" fever. Figure 1 shows typical temperature curves for the three strains and illustrates the similarity between the "B. R." and the "W" strains.

In order to observe simultaneously some of the aspects of the 3 strains, each was inoculated into 12 male (500-gm.) guinea pigs. The inoculation consisted of 1 cc. of whole blood injected intra-

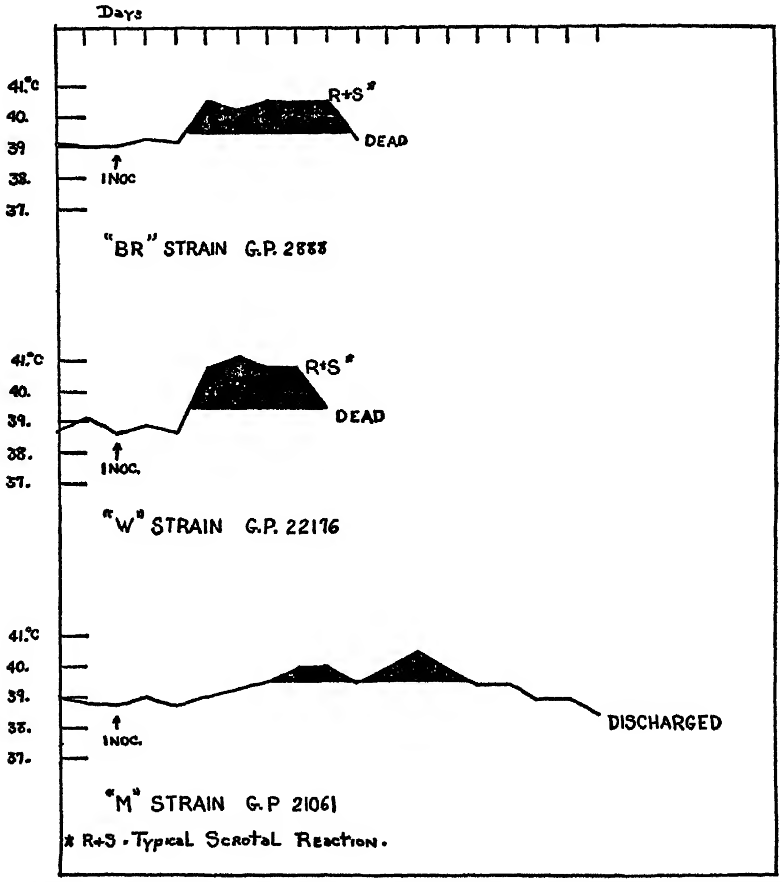

FIGURE 1.—Daily temperature records of guinea pigs inoculated with different strain of Rocky Mountain spotted fever

peritoneally, drawn from an infected guinea pig on the second day of fever.

The data for these 36 guinea pigs are summarized in table 2.

TABLE 2

Strain	Number of guinea pigs	Incubation period	Number died	Number recovered	Number with scrotal lesions
B. R.	12	2 6	7	5	9
W.	12	3 1	6	6	10
M.	12	4 2	0	12	0

These data illustrate the very close similarity between the "B. R." and the "W" strains. The 3-day incubation period for the "W" strain represents the shortest period that we have observed in strains isolated in the East. The usual incubation period for these strains has been between 4 and 6 days or even a little longer.

The isolation of a strain of spotted fever which on inoculation into guinea pigs produces the typical picture (short incubation period, high fatality rate, and necrosis of the scrotum) characteristic of the strains usually encountered in the Northwest leads us to question the further use of the terms "western type" and "eastern type" in reference to spotted fever strains. We have no evidence that this strain ("W") of spotted fever had any direct or indirect connection with the West, nor have we any acceptable evidence regarding any of the other strains isolated in the East. It is, of course, possible that there may be strains of virus in Montana which will produce in guinea pigs the picture usually associated with eastern strains, although reports of such are not found in the literature. With the reporting of the new strain in this paper, it would seem that spotted fever strains can be more accurately described by reference to the virulence for guinea pigs and to the presence or absence of scrotal involvement than by a geographical designation which does not hold true in all instances.

SUMMARY

A strain of Rocky Mountain spotted fever which has a short incubation period, high fatality rate, and commonly produces scrotal lesions in guinea pigs, has been isolated in the eastern United States. This strain has been compared to a typical highly virulent strain isolated in Montana and to a moderately virulent strain which does not produce scrotal lesions isolated in the eastern United States.

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(*1*) Badger, L. F., Dyer, R. E., and Rumreich, A.: An infection of the Rocky Mountain spotted fever type, identification in the eastern part of the United States. Pub. Health Rep., 46: 463–470 (Feb. 27, 1931).

CANCER MORTALITY IN THE UNITED STATES ACCORDING TO SITE, BY SEX AND AGE, 1938

The accompanying tables (1 and 2), recently issued by the Bureau of the Census,[1] present some interesting data on cancer mortality in the United States by sex and site of tumor for the years 1934–38 and by 10-year age groups for 1938.

[1] Vital Statistics—Special Reports, vol 9, No 25, pp 173-174, March 12, 1940.

A total of 149,214 deaths from cancer was recorded in this country in 1938, of which 69,857, or 47 percent, occurred in males, and 79,357, or 53 percent, in females (the respective distribution of the population by sex in 1930 being 50.6 and 49.4).

The recorded mortality from cancer and other malignant tumors of all sites, which has been shown to have increased in the registration States of 1900 from 68.3 in 1900 to 120.6 in 1935,[2] even with the changing age composition of the population taken into account, has shown a further continuous increase during the period 1934–1938. During the 4-year interval, the increase in recorded mortality from cancer amounted to 10.5 percent, as compared with an estimated increase of 2.8 percent in the population. An increase of 13 percent is shown for males as compared with 9 percent for females.

The largest percentage increase was recorded for cancer of the respiratory system (52 percent for males and 39 percent for females), while the only broad classification groups showing a decrease were cancer of the buccal cavity and pharynx (for both sexes) and cancer of the skin (for males only).

Cancer of the digestive tract and peritoneum was the most important group from the standpoint of number of deaths, causing 47 percent of the total cancer mortality in 1938. The number of deaths from cancer of the various sites grouped in this classification increased 9.3 percent for males and 6.8 percent for females during the 4-year period. Deaths from cancer of the genitourinary organs (uterus excluded) increased by about 20 percent for both sexes. In females, cancer of the uterus (which caused 20 percent of all cancer mortality in that sex in 1938) increased 4 percent, while cancer of the breast, also a numerically important cause of cancer mortality in women, increased 10 percent during the 4 years.

In table 2 the cancer deaths for 1938 are presented by site and 10-year age groups. The percentage of the total population (1930) in these age groups and the percentage of cancer mortality falling in these ages in 1938 are as follows:

	Under 10	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80 and over
Percent of population	19.6	19.2	16.9	14.9	12.2	8.7	5.4	2.5	0.6
Percent of cancer mortality	0.5	0.5	1.3	4.2	11.7	21.1	27.6	24.0	8.9

[2] Cancer Mortality in the United States. I. Trend of Recorded Cancer Mortality in the Death Registration States of 1900 from 1900 to 1935. By Mary Gover. Pub. Health Bull. No. 248. U. S. Government Printing Office, 1939.

TABLE 1.—*Number of deaths from cancer in the United States, by sex and site, 1934–38*

Cause of death	1938		1937		1936		1935		1934	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Cancer and other malignant tumors	69, 857	79, 357	67, 349	77, 425	65, 545	77, 068	62, 933	74, 716	61, 610	72, 818
Cancer of the buccal cavity and pharynx	4, 030	901	4, 007	974	4, 004	989	3, 982	923	4, 064	945
Lip	657	63	693	78	681	83	671	56	654	58
Tongue	943	172	860	198	887	210	878	198	864	192
Mouth	440	130	441	138	487	133	441	109	441	114
Jaw	718	192	704	216	724	226	776	223	825	228
Other and unspecified parts of buccal cavity	485	143	514	134	524	126	466	134	479	132
Pharynx	787	201	795	210	701	211	750	203	801	221
Cancer of the digestive tract and peritoneum	38, 126	32, 081	37, 307	32, 028	36, 280	31, 959	35, 224	31, 237	34, 886	30, 590
Esophagus	1, 952	546	2, 035	546	1, 846	540	1, 715	511	1, 747	496
Stomach and duodenum	16, 288	10, 814	16, 150	10, 758	16, 210	11, 031	16, 077	11, 027	15, 894	10, 975
Intestines (except duodenum, rectum, anus)	7, 585	9, 103	7, 175	8, 803	6, 833	8, 531	6, 428	8, 037	6, 358	7, 747
Rectum and anus	4, 727	3, 718	4, 413	3, 481	3, 975	3, 350	3, 824	3, 237	3, 692	3, 048
Liver and biliary passages	4, 303	5, 763	4, 418	5, 879	4, 490	5, 935	4, 434	6, 045	4, 596	6, 072
Pancreas	2, 737	2, 169	2, 594	2, 011	2, 446	1, 994	2, 309	1, 809	2, 126	1, 649
Mesentery and peritoneum	511	520	500	533	462	560	424	526	441	558
Others under this title	23	30	22	17	18	18	13	15	32	45
Cancer of the respiratory system	6, 065	2, 056	5, 484	1, 872	4, 931	1, 909	4, 478	1, 723	3, 989	1, 484
Larynx	1, 197	143	1, 083	154	1, 069	170	987	165	963	137
Lungs and pleura	3, 669	1, 631	3, 464	1, 521	3, 099	1, 549	2, 951	1, 405	2, 631	1, 246
Other respiratory organs	1, 199	282	937	197	763	190	540	153	395	101
Cancer of the uterus	-------	16, 291	-------	16, 338	-------	16, 280	-------	15, 853	-------	15, 635
Cancer of other female genital organs	-------	3, 944	-------	3, 643	-------	3, 553	-------	3, 345	-------	3, 271
Ovary and Fallopian tube	-------	3, 312	-------	3, 018	-------	2, 941	-------	2, 795	-------	2, 676
Vagina and vulva	-------	577	-------	577	-------	568	-------	509	-------	545
Other female genital organs	-------	55	-------	48	-------	44	-------	41	-------	50
Cancer of the breast	145	14, 315	182	13, 757	171	13, 537	162	13, 064	161	13, 010
Cancer of the male genitourinary organs	13, 539	-------	12, 651	-------	12, 356	-------	11, 702	-------	11, 342	-------
Kidneys and suprarenals	1, 414	-------	1, 283	-------	1, 244	-------	1, 178	-------	1, 149	-------
Bladder	3, 216	-------	3, 084	-------	3, 148	-------	3, 014	-------	2, 825	-------
Prostate	8, 069	-------	7, 490	-------	7, 140	-------	6, 765	-------	6, 578	-------
Testes	482	-------	466	-------	476	-------	412	-------	452	-------
Scrotum	32	-------	24	-------	26	-------	34	-------	30	-------
Other male genitourinary organs	326	-------	304	-------	322	-------	299	-------	308	-------
Cancer of the skin	2, 039	1, 301	2, 048	1, 294	2, 065	1, 339	2, 113	1, 278	2, 073	1, 242
Cancer of other or unspecified organs	5, 913	7, 868	5, 670	7, 519	5, 738	7, 502	5, 272	7, 293	5, 095	6, 641
Kidneys and suprarenals (female)	-------	937	-------	879	-------	831	-------	870	-------	865
Bladder (female)	-------	1, 535	-------	1, 567	-------	1, 505	-------	1, 485	-------	1, 351
Brain	977	646	802	576	750	534	654	487	715	449
Bones (except of jaw)	1, 134	977	1, 017	861	1, 063	913	889	875	968	864
Other or unspecified organs	3, 802	3, 773	3, 851	3, 636	3, 925	3, 719	3, 729	3, 576	3, 412	3, 112

TABLE 2.—*Number of deaths from cancer, by age and site, 1938*

Cause of death	Total	Under 10 years	10 to 19 years	20 to 29 years	30 to 39 years	40 to 49 years	50 to 59 years	60 to 69 years	70 to 79 years	80 to 89 years	90 and over	Not stated
Cancer and other malignant tumors	149, 214	719	713	1, 985	6, 296	17, 177	31, 541	41, 241	35, 871	12, 289	1, 000	49
Cancer of the buccal cavity and pharynx	4, 031	13	16	26	96	381	959	1, 412	1, 375	570	53	-----
Lip	720	1	-----	3	18	39	108	198	227	106	20	-----
Tongue	1, 115	-----	-----	4	21	109	238	303	265	111	4	-----
Mouth	570	-----	-----	-----	7	37	101	163	171	84	7	-----
Jaw	910	9	9	11	23	68	143	247	290	101	9	-----
Other and unspecified parts of buccal cavity	628	2	3	3	8	53	143	176	152	82	6	-----
Pharynx	988	1	4	5	19	75	226	295	270	86	7	-----
Cancer of the digestive tract and peritoneum	70, 807	124	81	498	1, 833	6, 275	14, 174	21, 497	19, 530	6, 348	427	20
Esophagus	2, 498	-----	1	7	26	184	648	850	631	139	11	1
Stomach and duodenum	27, 102	8	16	105	560	2, 164	5, 226	8, 309	7, 986	2, 550	168	10
Intestines (except duodenum, rectum, anus)	16, 688	26	24	152	558	1, 583	3, 266	4, 779	4, 564	1, 608	122	6
Rectum and anus	8, 445	6	7	102	305	882	1, 806	2, 636	2, 021	636	43	1
Liver and biliary passages	10, 066	81	15	62	207	820	1, 881	3, 114	2, 892	974	67	-----
Pancreas	4, 906	-----	4	26	97	479	1, 106	1, 517	1, 271	392	13	1
Mesentery and peritoneum	1, 010	53	14	44	78	156	227	273	151	41	2	1
Others under this title	62	-----	-----	-----	2	7	11	10	14	8	1	-----
Cancer of the respiratory system	8, 121	27	68	133	336	1, 322	2, 387	2, 336	1, 213	283	15	1
Larynx	1, 340	-----	1	3	27	163	330	428	289	99	1	-----
Lungs and pleura	5, 300	26	63	110	243	836	1, 560	1, 517	767	168	9	1
Other respiratory organs	1, 481	1	4	20	66	323	488	391	157	26	5	-----
Cancer of the uterus	16, 291	6	7	381	1, 602	3, 520	4, 193	3, 672	2, 252	607	43	8
Cancer of other female genital organs	3, 944	7	36	103	299	771	1, 077	963	549	133	5	1
Ovary and Fallopian tube	3, 312	6	34	95	270	704	967	791	377	66	1	1
Vagina and vulva	577	-----	2	8	26	54	100	155	165	63	4	-----
Other female genital organs	55	1	-----	-----	3	13	10	17	7	4	---	-----
Cancer of the breast	14, 460	-----	4	99	929	2, 608	3, 768	3, 578	2, 460	918	89	7
Cancer of the male genitourinary organs	13, 539	106	30	163	281	627	1, 757	3, 869	4, 898	1, 686	106	7
Kidneys and suprarenals	1, 414	83	18	29	86	219	370	388	185	31	1	1
Bladder	3, 216	7	2	6	31	188	587	900	1, 056	356	23	-----
Prostate	8, 069	4	3	4	16	114	700	2, 395	3, 521	1, 227	80	5
Testes	482	12	15	117	126	70	45	40	38	18	--	1
Scrotum	32	-----	1	-----	3	4	9	5	6	3	1	-----
Other male genitourinary organs	326	-----	-----	7	19	32	46	81	92	48	1	-----
Cancer of the skin	3, 340	12	11	45	72	186	352	659	1, 005	839	158	1
Cancer of other or unspecified organs	13, 781	424	481	537	848	1, 787	2, 874	3, 228	2, 589	905	104	4
Kidneys and suprarenals (female)	937	83	13	17	44	108	199	200	167	43	3	-----
Bladder (female)	1, 535	1	-----	6	34	90	267	487	461	174	13	2
Brain	1, 623	140	113	130	230	391	387	180	43	8	1	-----
Bones (except of jaw)	2, 111	41	187	131	123	254	425	402	345	104	8	1
Other or unspecified organs	7, 575	159	168	253	417	944	1, 596	1, 809	1, 573	576	79	1

For age groups up to age 49 the percentage of cancer mortality is below the percentage of the population in each group, but from that

age on the percentage of total cancer mortality is increasingly higher than the percentage of population in each age group.

The 1938 death rates for cancer for all sites and for 9 broad classifications, by 10-year age groups, computed on the basis of the estimated population as of July 1, 1938, are as follows:

TABLE 3.—*Death rates per 100,000 for cancer and other malignant tumors by 10-year age groups, 1938* [1]

Site	Under 10 years	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80 and over
All sites	2.8	3.0	9.0	32.4	110.0	278.4	586.5	1,101.9	1,700.9
Buccal cavity and pharynx	[2]	[2]	[2]	[2]	2.4	8.5	20.5	42.2	79.7
Digestive tract and peritoneum	[2]	[2]	2.3	9.4	57.6	125.1	305.7	599.9	867.1
Respiratory system	[2]	[2]	[2]	1.7	8.3	21.1	33.2	37.3	38.1
Uterus	[2]	[2]	1.7	8.2	22.1	37.0	52.2	69.2	83.2
Other female genital organs	[2]	[2]	[2]	1.5	4.8	9.5	13.7	16.9	17.7
Breast	[2]	[2]	[2]	4.8	16.4	33.3	50.9	75.6	128.9
Male genitourinary organs	[2]	[2]	[2]	1.4	3.9	15.5	55.0	150.4	229.4
Skin	[2]	[2]	[2]	[2]	1.2	3.1	9.4	30.9	127.6
Other unspecified organs	1.7	1.9	2.4	4.4	11.2	25.4	45.9	79.5	129.1

[1] Rates computed by the Public Health Service on the basis of the 1930 percentage age distribution of the population.
[2] Less than 1 per 100,000.

COURT DECISION ON PUBLIC HEALTH

Recovery by restaurant patron for trichinosis.—(New York Court of Appeals; *Eisenbach* v. *Gimbel Bros., Inc., et al.*, 24 N.E.2d 131; decided November 21, 1939.) The plaintiff was served smoked pork tenderloin at a restaurant and thereafter became infected with trichinosis. He brought an action against the restaurant keeper for breach of warranty of the fitness of the meat for human food. The trial judge, in his charge to the jury, said:

> Of course, if the pork tenderloin was cooked so that all of it reached a temperature of at least 137 degrees, it is conceded by everybody that it did not have any live trichinae left in it. * * * So, if you believe the chef's testimony that he cooked this pork tenderloin for 2 hours or more in boiling water, and if you believe the testimony * * * to the effect that if pork tenderloin is cooked for even an hour in boiling water the temperature reaches 137 degrees even in the center of the pork tenderloin, then you have a right to conclude that trichinae were no longer alive in this pork tenderloin, even if they were there to start with, and that the plaintiff could not have gotten his trichinosis from this particular piece of pork tenderloin.

There was a verdict for the plaintiff and the court of appeals stated that, in view of the above instructions, such verdict must be taken as a finding that the defendant did not adequately discharge its undertaking properly to cook the meat it served to the plaintiff. The plaintiff's recovery was affirmed but, inasmuch as the meat had not been cooked as the restaurant keeper concededly knew it ought to have been cooked, the appellate court held that such restaurant keeper had no case against the wholesaler from whom the meat had been

purchased (and so the wholesaler had no case against its vendor, a packer) because the wholesaler was entitled to invoke against the restaurant keeper the principle that a party cannot recover for a loss that he could have averted by the exercise of due care.

DEATHS DURING WEEK ENDED APRIL 6, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Apr. 6, 1940	Corresponding week, 1939
Data from 87 large cities of the United States:		
Total deaths	9,197	[1] 8,863
Average for 3 prior years	8,965	
Total deaths, first 14 weeks of year	132,062	131,848
Deaths under 1 year of age	551	[1] 499
Average for 3 prior years	540	
Deaths under 1 year of age, first 14 weeks of year	7,248	7,690
Data from industrial insurance companies:		
Policies in force	65,866,801	67,615,322
Number of death claims	13,926	15,639
Death claims per 1,000 policies in force, annual rate	11.1	12.1
Death claims per 1,000 policies, first 14 weeks of year, annual rate	10.7	11.4

[1] Data for 88 cities.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED APRIL 20, 1940

Summary

On the basis of weekly reports received from State health officers, little change from last week is indicated in conditions in the United States with respect to the nine important communicable diseases. The incidence of diphtheria, influenza, scarlet fever, and whooping cough declined, while that of measles, meningococcus meningitis, poliomyelitis, smallpox, and typhoid fever registered slight increases. All of the nine diseases included in the table, with the exception of influenza, were below the median (1935–39) expectancy for the current week, and the cumulated totals for the first 16 weeks of the current year, ended with the week of April 20, are below the 5-year median expectancies for the corresponding period for all diseases except influenza and poliomyelitis.

For the current week, 38 cases of smallpox were reported in Iowa, where 19 cases occurred last week, 10 cases of typhoid fever in Texas, 3 cases of Rocky Mountain spotted fever in Wyoming and 1 case in Montana, 1 case of undulant fever in Maryland, 2 cases of tularaemia in South Carolina and 1 case in Mississippi, and a total of 15 cases of endemic typhus fever distributed in 7 South Atlantic and South Central States.

Telegraphic morbidity reports from State health officers for the week ended April 20, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Apr. 20, 1940	Apr. 22, 1939		Apr. 20, 1940	Apr. 22, 1939		Apr. 20, 1940	Apr. 22, 1939		Apr. 20, 1940	Apr. 22, 1939	
NEW ENG.												
Maine	0	4	2	1	40	8	507	43	109	0	0	0
New Hampshire	0	0	0	------	------	------	30	1	15	0	0	0
Vermont	0	0	0	------	------	------	1	58	58	0	0	0
Massachusetts	2	1	3	------	------	------	513	884	621	0	2	3
Rhode Island	0	0	0	------	------	------	181	49	78	0	0	1
Connecticut	1	1	2	4	15	6	47	995	632	0	0	1
MID. ATL.												
New York	17	19	33	[1] 15	[1] 28	[1] 10	711	1,782	2,653	4	8	8
New Jersey	9	15	12	5	8	8	534	52	1,244	0	1	2
Pennsylvania	14	26	38	------	------	------	410	63	1,509	11	4	8
E. NO. CEN.												
Ohio	7	19	19	23	------	19	14	17	1,041	2	0	2
Indiana	4	9	10	24	53	22	25	19	365	0	0	1
Illinois	16	27	35	26	64	54	99	25	188	0	4	5
Michigan [2]	7	4	9	1	17	2	671	493	493	0	2	3
Wisconsin	0	0	1	62	124	52	478	751	751	0	1	1
W. NO. CEN.												
Minnesota	1	3	3	4	4	2	170	442	442	1	0	1
Iowa	4	3	4	10	35	8	98	196	196	0	1	1
Missouri	7	5	21	8	------	92	45	8	56	0	1	6
North Dakota	0	0	4	2	31	13	1	24	24	0	0	0
South Dakota	0	1	1	1	8	------	6	269	15	0	0	0
Nebraska	0	2	2	5	43	------	8	335	154	0	0	0
Kansas	11	2	2	8	31	8	638	47	47	0	0	0
SO. ATL.												
Delaware	0	1	1	------	------	------	5	1	13	0	0	0
Maryland [2]	4	0	2	5	10	10	18	458	255	1	2	4
Dist. of Col.	0	2	4	2	4	1	4	357	96	0	0	2
Virginia	9	14	11	224	505	------	131	682	617	1	2	7
West Virginia [2]	1	4	7	44	119	37	14	10	108	2	2	4
North Carolina [3]	14	21	12	3	43	18	218	761	226	2	2	2
South Carolina [3]	10	6	5	416	623	299	8	32	30	1	2	1
Georgia [4]	12	7	4	55	475	131	140	91	------	1	0	0
Florida [3]	0	2	2	8	7	2	107	232	81	0	0	0
E. SO. CEN.												
Kentucky	8	9	7	9	58	20	77	22	375	1	2	4
Tennessee	3	2	5	147	202	48	154	85	63	0	2	5
Alabama [3]	5	5	9	85	631	151	57	132	132	4	2	2
Mississippi [2]	2	7	2	------	------	------	------	------	------	0	1	1
W. SO. CEN.												
Arkansas	7	4	4	95	303	107	27	58	58	0	1	1
Louisiana [3]	5	11	13	9	15	15	9	206	35	1	0	8
Oklahoma	3	5	10	183	277	108	40	348	91	0	0	1
Texas [3]	16	18	34	555	909	504	1,140	313	313	6	1	4
MOUNTAIN												
Montana [4]	2	0	0	17	34	27	25	127	23	0	0	0
Idaho	1	0	0	------	27	7	42	225	19	0	0	0
Wyoming [4]	2	0	0	------	------	------	23	10	11	0	0	0
Colorado [5]	6	12	7	6	18	------	35	366	233	0	0	1
New Mexico	0	8	8	------	19	6	41	27	49	1	1	1
Arizona	2	0	1	122	149	51	151	10	29	0	1	0
Utah [2]	0	0	0	10	75	------	638	146	81	0	0	0
PACIFIC												
Washington	2	0	0	------	------	------	836	856	842	0	1	1
Oregon	5	1	1	8	70	33	678	96	96	0	0	1
California	19	13	24	41	69	69	504	3,364	1,413	1	2	4
Total	238	288	445	2,243	5,143	2,117	10,309	15,568	15,568	40	48	154
16 weeks	5,723	7,530	8,902	157,526	134,670	122,260	106,305	211,902	211,902	635	814	2,138

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 20, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Apr. 20, 1940	Apr. 22, 1939		Apr. 20, 1940	Apr. 22, 1939		Apr. 20, 1940	Apr. 22, 1939		Apr. 20, 1940	Apr. 22, 1939	
NEW ENG.												
Maine	0	0	0	9	23	23	0	0	0	0	0	0
New Hampshire	0	0	0	4	14	7	0	0	0	0	0	0
Vermont	0	0	0	21	13	9	0	0	0	3	0	0
Massachusetts	0	0	0	173	181	245	0	0	0	0	1	1
Rhode Island	0	0	0	29	19	19	0	0	0	1	0	0
Connecticut	0	0	0	94	94	110	0	0	0	0	1	1
MID. ATL.												
New York	0	6	0	918	519	965	0	1	0	2	9	7
New Jersey	0	0	0	478	156	173	0	0	0	4	3	3
Pennsylvania	1	0	0	379	327	589	0	0	0	11	3	3
E. NO. CEN.												
Ohio	1	9	1	220	401	401	0	13	3	3	2	6
Indiana	0	0	0	181	223	168	1	85	19	1	0	1
Illinois	0	0	0	875	487	705	1	17	17	5	4	4
Michigan [3]	0	0	0	323	454	454	3	15	1	4	0	2
Wisconsin	0	0	0	128	169	305	6	5	9	1	0	2
W. NO. CEN.												
Minnesota	1	0	0	80	90	158	3	9	10	0	1	0
Iowa	1	1	0	54	107	179	38	42	34	0	0	0
Missouri	0	0	0	85	71	86	1	42	27	2	2	2
North Dakota	0	0	0	11	7	32	2	12	12	2	0	0
South Dakota	0	0	0	19	20	20	4	8	8	0	1	0
Nebraska	0	0	0	10	16	57	0	1	11	0	0	0
Kansas	1	0	0	50	97	111	1	5	20	1	2	2
SO. ATL.												
Delaware	0	0	0	15	10	7	0	0	0	0	0	0
Maryland [2]	0	0	0	22	37	69	0	0	0	1	4	4
Dist. of Col.	0	0	0	19	15	18	0	0	0	0	0	0
Virginia	0	1	0	49	33	31	0	0	0	1	1	2
West Virginia [2]	1	0	0	29	26	47	0	0	0	0	3	3
North Carolina [3]	0	1	1	20	27	24	0	1	1	2	3	2
South Carolina [3]	2	6	0	5	4	3	0	0	0	1	4	1
Georgia [3]	0	0	0	10	15	6	0	0	0	2	4	6
Florida [3]	0	1	0	5	5	5	0	0	0	1	4	4
E. SO. CEN.												
Kentucky	0	2	0	83	53	53	0	7	1	5	4	4
Tennessee	0	0	0	99	51	25	0	8	0	1	2	1
Alabama [3]	1	0	0	15	10	8	6	0	0	5	4	1
Mississippi [3]	0	1	1	7	0	3	1	2	1	3	0	0
W. SO. CEN.												
Arkansas	1	0	0	1	7	7	2	1	1	1	5	3
Louisiana [3]	0	0	0	6	16	9	1	0	0	3	13	13
Oklahoma	0	2	0	16	0	23	0	44	3	3	1	2
Texas [3]	1	2	2	35	35	59	6	12	8	10	7	7
MOUNTAIN												
Montana [4]	0	0	0	31	22	22	0	2	5	0	0	0
Idaho	0	0	0	11	3	6	0	3	3	0	0	0
Wyoming [4]	0	0	0	3	7	7	0	0	2	0	0	0
Colorado [5]	0	0	0	30	47	47	7	6	4	0	1	1
New Mexico	0	0	0	12	16	16	0	0	0	2	1	2
Arizona	0	1	0	8	5	16	0	2	0	2	0	1
Utah [2]	0	0	0	11	18	60	0	1	1	0	0	0
PACIFIC												
Washington	0	0	0	46	39	39	0	0	14	1	0	1
Oregon	0	0	0	11	18	53	0	11	11	0	1	1
California	2	1	2	141	173	202	3	11	11	6	7	7
Total	13	34	16	4,881	4,180	7,018	86	366	366	90	98	107
16 weeks	399	264	326	76,587	81,915	110,251	1,159	5,787	5,097	1,255	1,839	1,839

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 20, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Whooping cough, Week ended— Apr. 20, 1940	Whooping cough, Week ended— Apr. 22, 1939
NEW ENG.		
Maine	19	53
New Hampshire	5	1
Vermont	23	37
Massachusetts	116	156
Rhode Island	7	75
Connecticut	25	73
MID. ATL.		
New York	442	369
New Jersey	105	327
Pennsylvania	265	273
E. NO. CEN.		
Ohio	187	123
Indiana	36	57
Illinois	104	247
Michigan [2]	181	148
Wisconsin	77	154
W. NO. CEN.		
Minnesota	38	48
Iowa	32	9
Missouri	22	13
North Dakota	2	6
South Dakota	4	3
Nebraska	2	10
Kansas	20	31
SO. ATL.		
Delaware	14	10
Maryland [2]	147	19
Dist. of Col	7	29
Virginia	91	51
West Virginia [2]	38	9
North Carolina [3]	92	216
South Carolina [3]	33	62
SO. ATL.—continued		
Georgia [3]	23	29
Florida [3]	6	45
E. SO. CEN.		
Kentucky	80	10
Tennessee	33	16
Alabama [3]	22	33
Mississippi [2]	---	---
W. SO. CEN.		
Arkansas	11	11
Louisiana [3]	9	36
Oklahoma	22	4
Texas [3]	293	100
MOUNTAIN		
Montana [4]	5	6
Idaho	10	12
Wyoming [4]	4	1
Colorado [5]	18	52
New Mexico	21	20
Arizona	36	24
Utah [2]	97	51
PACIFIC		
Washington	67	6
Oregon	53	30
California	418	241
Total	3,362	3,336
16 weeks	48,330	65,233

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Apr. 20, 1940, 15 cases, as follows: North Carolina, 1; South Carolina, 2; Georgia, 6; Florida, 2; Alabama, 1; Louisiana, 2; Texas, 1.
[4] Rocky Mountain spotted fever, week ended Apr. 20, 1940, 4 cases, as follows: Montana, 1; Wyoming, 3.
[5] Colorado tick fever, week ended Apr. 20, 1940, Colorado, 2 cases.

WEEKLY REPORTS FROM CITIES

City reports for week ended April 6, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	145	359	91	7,869	799	2,391	24	399	21	1,235	--------
Current week [1]	67	164	60	2,148	524	1,957	2	351	15	1,025	--------
Maine:											
Portland	0	------	0	141	2	0	0	0	0	5	29
New Hampshire:											
Concord	0	------	0	1	0	0	0	0	0	0	12
Manchester	0	------	0	2	0	0	0	0	0	0	17
Nashua	0	------	0	59	0	1	0	0	0	0	9
Vermont:											
Barre	0	------	0	0	0	0	0	0	0	0	3
Burlington	0	------	0	0	0	0	0	0	0	0	8
Rutland	0	------	0	0	0	0	0	0	0	0	9
Massachusetts:											
Boston	0	------	1	84	25	59	0	11	0	39	262
Fall River	0	------	0	22	3	2	0	0	0	14	30
Springfield	0	------	0	2	0	5	0	0	0	14	39
Worcester	0	------	0	4	7	6	0	1	0	0	45
Rhode Island:											
Providence	0	------	0	118	3	12	0	2	0	8	78
Connecticut:											
Bridgeport	0	1	1	2	2	1	0	1	1	1	34
Hartford	0	1	0	0	4	6	0	3	1	3	52
New Haven	0	4	0	0	6	1	0	0	0	3	35
New York:											
Buffalo	0	------	0	1	13	11	0	3	0	6	157
New York	16	11	4	96	101	579	0	78	3	102	1,705
Rochester	0	2	0	3	5	15	0	1	0	11	66
Syracuse	1	------	0	0	2	15	0	1	0	9	42
New Jersey:											
Camden	0	1	1	0	3	12	0	2	0	1	33
Newark	0	1	0	210	4	24	0	5	0	12	109
Trenton	0	------	0	0	2	1	0	1	0	3	34
Pennsylvania:											
Philadelphia	0	3	3	43	25	126	0	19	1	35	582
Pittsburgh	2	3	2	5	15	25	0	9	0	11	191
Reading	1	------	0	2	1	1	0	0	0	10	30
Scranton	0	------	--------	1	-------	0	0	-------	0	0	--------
Ohio:											
Cincinnati	0	1	2	3	9	11	0	13	0	26	147
Cleveland	4	20	3	5	14	41	0	15	0	43	226
Columbus	1	------	0	2	8	9	0	1	0	3	103
Toledo	0	2	1	2	7	25	0	3	0	14	82
Indiana:											
Anderson	0	------	0	1	0	2	0	0	0	2	10
Fort Wayne	1	------	0	0	3	1	0	0	0	2	47
Indianapolis	2	------	1	2	11	31	0	3	0	5	133
Muncie	0	------	0	0	1	2	1	0	0	0	10
South Bend	------	------	------	------	------	------	------	------	------	------	------
Terre Haute	0	------	0	1	0	2	0	0	0	2	11
Illinois:											
Alton	1	------	0	0	1	0	0	0	0	1	11
Chicago	10	3	1	26	34	602	0	32	0	70	763
Elgin	1	------	0	1	0	2	0	0	0	1	10
Moline	0	------	0	2	0	2	0	0	0	0	17
Springfield	1	------	1	0	2	4	0	0	0	9	26
Michigan:											
Detroit	3	4	1	53	13	65	0	18	0	23	275
Flint	0	------	0	6	3	18	0	0	0	13	37
Grand Rapids	0	------	0	5	2	15	0	1	0	13	40
Wisconsin:											
Kenosha	0	------	0	18	0	2	0	0	0	0	15
Madison	0	------	0	1	0	1	0	0	0	3	8
Milwaukee	1	3	3	13	11	20	0	1	0	7	129
Racine	0	------	0	0	0	1	0	0	0	0	13
Superior	0	------	0	109	0	3	0	0	0	0	8

[1] Figures for South Bend and Boise estimated; reports not received.

City reports for week ended April 6, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	1	72	2	1	0	0	0	0	32
Minneapolis	0	------	1	0	4	22	0	1	0	13	106
St. Paul	0	------	0	2	2	12	0	2	0	12	68
Iowa:											
Cedar Rapids	0	------	------	54	------	1	0	------	0	0	------
Davenport	1	------	------	11	------	4	0	------	0	0	------
Des Moines	0	------	0	16	0	4	3	0	0	0	36
Sioux City	1	------	------	0	------	0	0	------	0	0	------
Waterloo	0	------	------	0	------	4	0	------	0	0	------
Missouri:											
Kansas City	0	------	0	8	2	13	0	4	0	0	92
St. Joseph	0	------	0	0	2	1	0	1	0	1	38
St. Louis	2	------	0	2	8	30	0	3	0	17	209
North Dakota:											
Fargo	0	------	0	0	2	0	1	0	0	0	9
Grand Forks	0	------	------	0	------	1	0	------	0	0	------
Minot	0	------	0	0	0	1	0	0	0	0	8
South Dakota:											
Aberdeen	0	------	------	1	------	1	0	------	0	1	------
Sioux Falls	0	------	0	0	0	4	0	0	0	0	11
Nebraska:											
Lincoln	0	------	------	4	------	6	0	------	0	0	------
Omaha	2	------	0	7	8	0	0	2	0	0	54
Kansas:											
Lawrence	0	4	0	0	0	0	0	0	0	0	7
Topeka	0	1	1	1	7	0	0	2	0	0	38
Wichita	0	------	0	110	4	1	0	0	0	5	22
Delaware:											
Wilmington	1	------	0	1	8	3	0	0	0	5	28
Maryland:											
Baltimore	0	18	4	0	26	13	0	9	0	208	278
Cumberland	0	------	0	1	1	1	0	0	0	0	11
Frederick	0	------	0	0	0	0	0	0	0	0	6
Dist. of Col.:											
Washington	1	------	0	2	11	17	0	13	0	14	169
Virginia:											
Lynchburg	0	------	0	0	1	1	0	1	1	26	9
Norfolk	0	9	0	7	1	9	0	1	0	7	41
Richmond	1	------	0	1	2	5	0	0	0	2	48
Roanoke	0	------	0	4	0	1	0	0	0	1	13
West Virginia:											
Charleston	0	2	0	1	1	0	0	0	0	3	13
Huntington	0	------	------	1	------	5	0	------	0	0	------
Wheeling	0	------	0	0	3	0	0	0	0	0	21
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	0	0	0	0	0	0	4
Wilmington	0	------	0	1	1	0	0	0	0	0	15
Winston-Salem	0	------	0	0	1	0	0	2	0	0	18
South Carolina:											
Charleston	0	20	1	0	0	1	0	0	0	0	27
Florence	0	------	0	0	4	0	0	0	0	0	19
Greenville	0	------	0	0	0	0	0	0	0	1	12
Georgia:											
Atlanta	0	13	2	13	5	2	0	3	1	7	79
Brunswick	0	------	0	0	0	0	0	0	0	0	7
Savannah	0	6	1	0	3	4	0	0	0	0	28
Florida:											
Miami	0	6	0	0	5	1	0	1	1	0	46
Tampa	0	1	1	65	1	0	0	1	0	5	31
Kentucky:											
Ashland	0	3	0	0	1	0	0	0	0	7	7
Covington	0	------	0	4	1	4	0	0	0	0	13
Lexington	0	------	0	8	1	1	0	2	0	6	17
Louisville	0	2	0	4	5	37	0	1	0	59	42
Tennessee:											
Knoxville	0	6	0	3	3	12	0	1	0	0	31
Memphis	0	3	2	13	8	22	0	9	1	25	88
Nashville	0	------	0	2	2	1	0	0	0	0	61
Alabama:											
Birmingham	0	7	0	10	7	2	0	4	1	2	64
Mobile	0	2	1	2	2	1	0	0	0	0	22
Montgomery	0	2	------	9	------	1	0	------	0	0	------
Arkansas:											
Fort Smith	0	3	------	0	------	2	0	------	0	0	------
Little Rock	0	10	0	0	3	1	0	2	0	0	------

City reports for week ended April 6, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Louisiana:											
Lake Charles	0	------	0	2	2	0	0	0	0	1	7
New Orleans	8	2	2	11	9	10	0	15	1	4	145
Shreveport	0	------	0	0	3	1	0	3	0	0	27
Oklahoma:											
Oklahoma City	0	------	0	0	4	4	0	2	0	0	41
Tulsa	0	------	------	1	------	8	0	------	0	18	------
Texas:											
Dallas	5	1	1	92	8	1	0	4	0	12	78
Fort Worth	0	------	0	5	2	0	0	0	0	43	23
Galveston	0	------	0	2	1	0	0	0	0	1	6
Houston	1	------	1	2	9	0	0	6	0	4	94
San Antonio	0	3	1	34	6	0	0	8	0	0	73
Montana:											
Billings	0	------	0	0	1	0	0	0	0	0	14
Great Falls	0	------	0	5	0	4	0	1	0	0	8
Helena	0	------	9	1	1	0	0	0	0	0	6
Missoula	0	------	0	0	0	1	0	0	0	1	3
Idaho:											
Boise	------	------	------	------	------	------	------	------	------	------	------
Colorado:											
Colorado Springs	0	------	0	0	0	2	0	1	0	0	10
Denver	7	------	1	17	8	8	0	4	0	0	81
Pueblo	1	------	0	5	2	5	0	0	0	0	16
New Mexico:											
Albuquerque	0	------	0	0	3	1	0	3	0	7	15
Utah:											
Salt Lake City	0	------	0	208	2	5	1	2	0	56	34
Washington:											
Seattle	0	------	3	381	5	2	0	1	0	27	96
Spokane	0	------	0	6	0	4	0	0	1	1	26
Tacoma	0	------	0	10	0	4	0	0	0	0	23
Oregon:											
Portland	5	1	1	205	2	2	0	2	0	6	74
Salem	0	------	------	5	------	0	0	------	0	0	------
California:											
Los Angeles	0	15	1	16	3	22	0	19	1	33	263
Sacramento	0	2	2	9	1	0	0	3	1	21	34
San Francisco	0	------	1	2	3	8	0	5	1	16	160

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
New York:			
Buffalo	1	1	0
New York	2	0	1
Pennsylvania:			
Pittsburgh	1	1	0
Ohio:			
Cleveland	1	0	1
Michigan:			
Flint	0	1	0
District of Columbia:			
Washington	0	0	1
California:			
Los Angeles	1	0	0
Sacramento	0	0	1

Dengue.—Cases: Charleston, S. C., 2.
Encephalitis, epidemic or lethargic.—Cases: New York, 2; Pittsburgh, 1; St. Louis, 1; Great Falls, 2.
Pellagra.—Cases: Chicago, 1; Savannah, 1; Birmingham, 1; Los Angeles, 3.
Typhus fever.—Cases: Charleston, S. C., 2; Tampa, 1; Mobile, 1; Los Angeles, 1.

FOREIGN REPORTS

CUBA

Provinces—Notifiable diseases—4 weeks ended March 30, 1940.—During the 4 weeks ended March 30, 1940, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer		3	1	2		6	12
Chickenpox	1	2	1	8	9		21
Diphtheria	3	18	1			5	27
Leprosy	2			1	1	3	7
Malaria	7	1		10	2	39	59
Measles		14	11	5		10	40
Poliomyelitis				1			1
Rabies		1					1
Scarlet fever		3	2			1	6
Trachoma					2		2
Tuberculosis	20	10	28	12	2	42	114
Typhoid fever	13	66	10	21	11	48	172

SWEDEN

Notifiable diseases—February 1940.—During the month of February 1940, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	6	Poliomyelitis	9
Diphtheria	20	Scarlet fever	3,080
Dysentery	15	Syphilis	33
Epidemic encephalitis	1	Typhoid fever	4
Gonorrhea	632	Undulant fever	3
Paratyphoid fever	8	Weil's disease	3

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January–February 1940	March 1940—week ended—				
				2	9	16	23	30
ASIA								
Afghanistan	D	578						
Ceylon: Batticaloa	C	7						
China	C	2,705						
Canton	C	9						
Hong Kong	C	684						
Shanghai	C	427						
Tientsin	C	34						
India	C	124,623	[1] 4,724					
Bassein	C	14						
Calcutta	C	3,927	258	37	50	59	65	71
Madras	C	6	1					
Negapatam	C	2						
Porto Novo	C		1					
Rangoon	C	18	20		2	1	4	2
India (French)	C	92	4					
India (Portuguese)	C	17						
Indochina (French)	C	1	315					
Iran	C	435						
Iraq: Basra	C	[2] 1						
Japan: Osaka	C	[3] 1						
Thailand	C	25	52	64		38		
Bangkok	C	7						

[1] For January 1940. [2] Suspected. [3] Imported.

PLAGUE

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January–February 1940	March 1940—week ended—				
				2	9	16	23	30
AFRICA								
Algeria: Algiers	C	1						
Belgian Congo	C	58	3					
British East Africa:								
Kenya	C	4	6					
Nyasaland	C	2						
Uganda	C	316	35					
Egypt: Asyut Province	C	102	90	22	36	33	23	27
Madagascar	C	620	[1] 143					
Rhodesia (Northern)	C		1					
Senegal. Dakar	D					[2] 1		
Tunisia: Tunis	C	1						
Plague-infected rats		5						
Union of South Africa	C	80	4					
ASIA								
China:								
Fukien Province	D	[3] 753						
Manchuria	D	332						
Dutch East Indies:								
Java:								
Batavia	C	[2] 1						
Batavia Residency	D	[4] 86						
Java and Madura	C	1,575	[1] 51					
India	C	37,204	[1] 2,887					
Bassein	C	12	1	1	5		1	1
Calcutta	C	2						
Cochin	C	3	1					
Plague-infected rats		4	3					
Rangoon	C	[5] 8	[2] 1	1	1	1		
Indochina (French)	C	2	2					

[1] For January 1940.
[2] Imported.
[3] Includes 94 deaths from pneumonic plague.
[4] Pneumonic.
[5] Includes 1 imported case.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE—Continued

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January–February 1940	March 1940—week ended—				
				2	9	16	23	30
Thailand:								
Bangkok	C		3					
Bichitr Province	C	4						
Bisnulok Province	C	35	3					
Dhonpuri Province	C		1					
Jayanad Province	C		3					
Kamphaeng Bajr Province	C		28		1			
Kanchanapuri Province	C		8	3		1		
Lampang Province	C	1						
Nagara Svarga Province	C		22		5	2		
Prae Province	C	6						
Sukhodaya Province	C		15		4			
Svargalok Province	C	30						
Tak Province	C	10						
EUROPE								
Portugal: Azores Islands	C		2					
SOUTH AMERICA								
Argentina:								
Jujuy Province	C	1						
Mendoza Province	C	1						
Salta Province	C	1	1					
San Luis Province	C	1						
Santiago del Estero Province.[6]								
Tucuman Province	C	1						
Bolivia	C	2						
Brazil:								
Alagoas State	C	43						
Bahia State	C	1						
Parahiba State	C	1						
Pernambuco State	C	32						
Sao Paulo State	C	1						
Ecuador:								
Chimborazo Province	C	24						
Riobamba	C	[4]16						
Guayaquil	C	3						
Plague-infected rats		45						
Loja	C	4						
Pueblo Viejo	C	3						
Peru:								
Ancash Department	C	1						
Cajamarca Department	C	10						
Lambayeque Department	C	12	[1]5					
Libertad Department	C	36	[1]25					
Lima Department	C	39	[1]11					
Piura Department	C	35	[1]3					
Venezuela[7]	C	3						
OCEANIA								
Hawaii Territory:								
Paauhau	C	[8]1						
Plague-infected rats		54	6			2	1	

[1] For January 1940.
[4] Pneumonic.
[6] Information dated Apr. 13, 1940, states that 5 cases of glandular plague, with 2 deaths, have occurred in Santiago del Estero Province, Argentina.
[7] For the period Dec. 7, 1939, to Jan. 4, 1940, 11 cases of plague with 8 deaths were reported from the interior of Venezuela.
[8] Pneumonic plague; proved fatal.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January–February 1940	March 1940—week ended— 2	9	16	23	30
AFRICA								
Algeria	C	6						
Angola	C	112						
Belgian Congo	C	1,651	615					
British East Africa	C	688	2					
Dahomey	C	68	17					
Eritrea	C	2						
French Equatorial Africa	C	45						
French Guinea	C	40						
Gibraltar	C						[1] 1	
Gold Coast	C	141						
Ivory Coast	C	370	66					
Morocco	C	10						
Mozambique	C	102						
Nigeria	C	4,620	393					
Niger Territory	C	134	146					
Nyasaland	C		5					
Portuguese East Africa	C	24						
Portuguese Guinea	C	122						
Rhodesia:								
Northern	C	34						
Southern	C	219	80					
Senegal	C	257	14		6			
Sierra Leone	C	51						
Sudan (Anglo-Egyptian)	C	552	103	29	11	20	28	13
Sudan (French)	C	27						
Union of South Africa	C	209		1				
ASIA								
Arabia	C	1	95					
Ceylon	C	1						
China	C	1,593	240	14	11	30		
Chosen	C	574						
Dutch East Indies—Sabang	C					4		
India	C	113,943	[2] 17,199					
India (French)	C	59	4					
Indochina (French)	C	3,043	516					
Iran	C	87	54					
Iraq	C	91	57	5			8	
Japan	C	229						[3] 262
Straits Settlements	C	1	1					
Syria	C	1						
Thailand	C	155						
EUROPE								
France	C	4						
Great Britain	C	1	2					
Greece	C	69	16					
Portugal	C	950	44			2		
Spain	C	747	144					
Canary Islands	C	3						
Turkey	C	428						
NORTH AMERICA								
Canada	C	160						
Guatemala	C	9	1					
Mexico	D	1,264	2					
Salvador	C	1						
SOUTH AMERICA								
Argentina	C	3						
Bolivia	C	247						
Brazil	C	26	1					
Colombia	C	2,784	99					
Ecuador	C	8						
Uruguay	C	5						
Venezuela (alastrim)	C	109	54			18		

[1] Imported.
[2] For January 1940.
[3] For the period Jan. 1 to Mar. 25, 1940.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER

[C indicates cases; D, deaths]

Place		Jan. 1–Dec. 31, 1939	January–February 1940	March 1940—week ended—				
				2	9	16	23	30
AFRICA								
Algeria	C	1,833	313		108			
Belgian Congo	C		1,188					
British East Africa	C	2	1					
Egypt	C	4,239	670	187	235	199		193
Eritrea	C	9						
Libya	C	37						
Morocco	C	901	44	12				10
Nigeria	C	3						
Portuguese East Africa	C	2						
Southern Rhodesia	C	8						
Swaziland	C	1						
Tunisia	C	6,104						
Union of South Africa	C	1,148	[1] 35					
ASIA								
China	C	308	66	22	19			
Chosen	C	734	1					
India	C	17	1					
Iran	C	86	112					
Iraq	C	49	3	3	1	1	10	11
Palestine	C	198	13	2	4		1	
Straits Settlements	C	16						
Sumatra	C	1						
Syria	C	5						
Trans-Jordan	C	19	13					
EUROPE								
Bulgaria	C	108	41					
Greece	C	45	2					[2] 4
Hungary	C	57	13			7	7	9
Irish Free State	C	5						
Latvia	C	3						
Lithuania	C	153						
Poland	C	8,140						
Portugal	C	27						
Rumania	C	942	566	65	48	61	78	50
Spain	C	62	3					
Turkey	C	471	320					
Yugoslavia	C	404	91	10				
NORTH AMERICA								
Cuba	C	4						
Guatemala	C	212	99					
Mexico	D	344	15					
Panama Canal Zone	C	3						
SOUTH AMERICA								
Bolivia	C	162						
Chile	C	1,244						
Ecuador	C							1
Peru	C	506						
Venezuela	C	10	3					
OCEANIA								
Australia	C	26	1					
Hawaii Territory	C	36	4	1	1		1	

[1] For January 1940.
[2] Suspected.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

YELLOW FEVER

[C indicates cases; D, deaths]

Place		Jan. 1-Dec. 31, 1939	January-February 1940	March 1940—week ended—				
				2	9	16	23	30
AFRICA								
Cameroon:								
Bafia	C	1						
Nkongsamba	C		[1] 1					
French Equatorial Africa:								
Bangui	C	[1] 1						
Chad—Fort Lamy	C	1						
Fort Archambault	C		[1] 1					
Gabon	D	1						
French Guinea	C	2						
Gold Coast	C	2						
Ivory Coast	C	[2] 25	1					
Nigeria	C	[3] 11						
Niger Territory:								
Dosso	C	3						
Konni Circle	C	3						
Tahua	C	[1] 1						
Senegal:								
Bambey	C	1						
Dakar	C	[1] 1						
Diourbel	C	6						
Louga	C	[1] 1						
Ziguinchor	C	10						
Sudan (French): Bandiagara	C	1						
Togo (French): Anecho	C	1						
SOUTH AMERICA								
Brazil:								
Amazonas State	D	[4] 1						
Bahia State	D	[4] 1						
Espirito Santo State	D	[5] 104	[4] 28					
Minas Geraes State	D	13						
Para State	D	3						
Rio de Janeiro State	D	3	[4] 1					
Colombia:								
Antioquia Department—								
Caracoli	D	3						
Jordan	D	1						
San Carlos	D	6						
San Luis	D		2					
Caldas Department—								
La Pradera	D		1					
Victoria	D		1					

[1] Suspected.
[2] Includes 8 suspected cases.
[3] Includes 3 suspected cases.
[4] Jungle type.
[5] Includes 8 deaths from the jungle type of yellow fever.

X

Public Health Reports

VOLUME 55 MAY 3, 1940 NUMBER 18

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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EFFECTIVE QUARANTINE SURVEILLANCE

By JOHN J. SIPPY, M. D., *District Health Officer, Stockton, California*

Surveillance, as a substitute for detention, is at present practiced in maintaining quarantine control of aircraft passengers from foreign ports. Since, to be effective, this procedure must involve the close and ready cooperation of all parties concerned, it is believed by the writer that the publication of the following report of a specific case will be of value in demonstrating the practicability of such cooperation.

A citizen of California had been employed for 6 months, prior to leaving South America for the United States, on a road-building project between San Lorenzo and Mototan, Venezuela. During that period he suffered two attacks of malarial fever and one of dysentery. Following enlargement of the inguinal glands, accompanied by slight fever, beginning about January 24, he was hospitalized at Maracaibo from January 31 to February 11. The medical officer in charge reported an absence of history of primary lesion. Kahn reaction on February 2 was negative, as was also the reaction to Frei antigen. The patient, however, received 9 injections of an organic antimony compound on the presumptive diagnosis of "tropical bubo."

On the morning of February 11 the patient left Maracaibo by airplane, arriving at Miami Beach, Fla., 11 hours later. His temperature on arrival was normal, and so he was not detained by the quarantine officer. During the night he suffered a chill, followed by unrecorded fever. Despite this illness, he left by plane from Miami Beach at noon on February 12. The travel schedule called for his arrival at Oakland on February 14, at noon; but owing to storm conditions, arrival was delayed 22 hours. While en route he suffered repeated chills and high temperatures.

Under date of February 12, this office was apprised by telegram from the U. S. Public Health Service at Miami Beach, Fla. that this passenger had passed through Miami en route to Stockton; and, since he came from a suspected yellow fever area, it was requested that he be kept under surveillance until February 18, and that development of any fever be reported. Contact with his family was established on February 13.

The patient arrived at Oakland, Calif., by plane at 10:15 a. m. on February 15, via Chattanooga, Indianapolis, Chicago, and Salt Lake City, and reached Stockton, Calif., by auto at noon. This office was advised of his arrival at 1:30 p. m. A slight delay was due to the fact that, while en route from Oakland to Stockton, the patient had a severe chill with fever, nausea, and vomiting, and was made comfortable before his wife telephoned.

When the patient was visited at 2 p. m., he complained of severe lumbar pain, his temperature by mouth was 103.8° F., pulse 130. He had enlarged and tender inguinal glands, but other clinical findings were essentially negative, and there was nothing to suggest the textbook picture of yellow fever. Since blood smears revealed numerous malaria parasites, a diagnosis of malarial fever seemed most logical, and the patient was placed under medical treatment with atabrine and quinine.

Except for one malarial paroxysm on the morning of February 17, the patient has responded to treatment, and his temperature has remained normal since February 18. The inguinal glands have entirely receded.

Laboratory tests for plague, relapsing fever, typhoid fever, and tularaemia were all negative. Examination of a blood smear revealed many malarial parasites (probably aestivo-autumnal), with numerous instances of multiple infection of red cells. The only laboratory finding at variance with the malaria picture was a moderate leucocytosis of 13,000.

The unusual features surrounding this case were as follows:

A. The possibilities of the presence of any one of several communicable infections, namely, yellow fever, plague, malignant malarial (blackwater) fever, and "tropical bubo."

B. The fact that, owing to rapidity of present airplane travel, persons from endemic areas throughout the world may bring such infections to any United States community before characteristic symptoms appear or can be recognized.

C. The vigilance of the United States Public Health Service at ports of entry which provides for prompt notification of local health authorities at the destination of travelers and thus permits the immediate institution of measures for prevention of spread of possible infections.

D. In this instance it was unnecessary to notify health officers at stops that had been made by the patient en route since, in the cold weather prevailing, danger of transmission at those points of any of the quarantinable diseases that exist in South America was negligible. During the summer, however, such notification would have been in order.

STUDIES ON THE TOXINS AND ANTITOXINS OF *CLOSTRIDIUM PERFRINGENS*[1]

By SARAH E. STEWART, *Assistant Bacteriologist, National Institute of Health, United States Public Health Service*

Introduction

Titrations of *Clostridium perfringens* toxins and antitoxins have yielded very inconsistent results in the hands of various workers. Such results are apparently dependent upon the interrelationship of the various antigenic components of the toxins that have been described. This suggests that the differences observed in the protective action of antitoxins may be due to the absence of certain antigenic components in the toxin used for immunization. A study has therefore been undertaken to determine some of the factors which influence the production of toxin with all the antigenic components for a given type, the nature of these antigens, and their significance in the production of an antitoxin which will give complete protection.

From theoretical consideration there were several possible factors that might be involved. (A) The nature of the toxin produced by a given strain might vary depending on: (1) Period of cultivation, (2) composition of the medium, (*a*) cysteine content, (*b*) meat and meat products in the medium, (*c*) glucose content. (B) If toxins vary in their composition depending on the medium used for cultivating the organisms the homologous antitoxins produced by immunizing with these toxins may vary depending on the presence or absence of the different components. (C) The nature of the different antigenic components may be such that the toxins are unstable.

Several different reactions are used for determining the titers of *perfringens* antitoxins. In 1920 Bengtson (*1*) promulgated a standard for the antitoxin of *Clostridium perfringens* of human origin. The unit was designated as that amount of antitoxin which would neutralize approximately 1,000 minimum lethal doses (m. l. d.) of a *perfringens* toxin. The tests were carried out by inoculating pigeons intramuscularly with different toxin-antitoxin mixtures. In 1930 the official unit for measuring the potency of the antitoxins was changed to one one-hundredth the former standard, as the unitage of antitoxins by the former method fell below 5 per cubic centimeter. This unit was adopted as the international standard (*19*).

Other methods which are used for measuring the titers of *perfringens* antitoxin are: (1) *In vitro* hemolytic titrations (Henry (*21*), Mason and Glenny (*25*)); (2) intradermal necrotic tests (Glenny et al. (*16*)); and (3) the mouse protection test (*10*).

[1] From the Division of Biologics Control, National Institute of Health, and Department of Bacteriology and Parasitology, University of Chicago

Using the above methods variations have been observed in the measurement of the protective power of certain antitoxins when tested against different lots of toxins. Marked irregularities have been reported with the method of *in vitro* hemolytic titrations (Henry (*21*), Weinberg and Guillaumie (*49*), Glenny (*17*), Prigge (*33*, *34*)). Unsatisfactory results have also been reported with the mouse protection test (Weinberg and Guillaumie (*49*)).

At the National Institute of Health, up to 1934, the routine testing of *perfringens* antitoxins had been carried out by the intramuscular injection of pigeons. This method gave quite consistent results. In 1934 comparative tests of the mouse intravenous method and the pigeon intramuscular method were made (*2*). The results showed a very close correlation of these two methods with the particular toxins and antitoxins used. A short time later when the mouse intravenous method was applied to the routine testing of antitoxins very irregular results were obtained. Great variations in the potencies of certain antitoxins were observed depending on the toxins used. Similar variations were found when the American standard antitoxin was tested against different lots of toxins. Because of these irregularities a study was undertaken to determine the causes for such discrepancies.

Literature

Since *Clostridium perfringens* (*Bacillus aerogenes capsulatus*, *Clostridium welchii*) was first isolated by Welch and Nuttall in 1892 (*50*) the pathogenic action of the organism has been attributed to a variety of different products. At first the acid, principally butyric, produced in a culture was considered as the cause of the lesions of gas gangrene (*8*). The gas produced in the tissues was also believed to be of importance in the spread of the infection (*27*). In 1917 Bull and Pritchett (*6*) first demonstrated that *Cl. perfringens* produces an exo-toxin when grown under suitable conditions, and they showed that a specific antitoxin could be produced by immunizing animals to the toxin. The toxin has been shown to be actively hemolytic, the hemolysin and the toxin being considered as identical by Ouranoff (*31*), Ford and Williams (*14*), Wuth (*55*), and Mason and Glenny (*25*). Others, however, have observed a multiplicity of the toxin components. In 1920 Weinberg and Nasta (*45*) found that the proportion of hemolysin in toxins of different strains varied considerably. More recently (1930) Schnayerson and Samuels (*35*) in studying the blood changes produced by the hemotoxin of *Cl. perfringens* in pigeons described two hemotoxins which differed in the rapidity of their action. Henry (*21*), in 1923, suggested that the organism in addition to the hemotoxin also produced a myotoxin. He was able to demonstrate a partial dissociation of the two lethal components by adsorption with ground fresh muscle. The muscle was found to reduce the

toxicity though causing little change in the hemolytic activity. As the result of pathological studies, others have described nonhemolytic toxin components and designated them according to their specific action on certain tissues. Weinberg and Barotte (*46*) have described a neurotoxin which caused a degeneration of nervous tissue. Weinberg and Combiesco (*47*) have described a toxic factor which was shown to be specific for the walls of blood vessels.

Still another toxic element attributed to this organism is the "nonspecific toxin" described by Wassermann (*42*), Kojima (*24*), Kendall and Schmitt (*23*), and Walbum and Reymann (*40*). They found that this "toxin" was produced when *Cl. perfringens* was grown in a medium containing glucose. It was not neutralized by the antitoxin and was found to kill mice instantaneously when inoculated intravenously. Kendall and Schmitt (*23*) found this "nonspecific toxin" to be a histamine-like substance.

Prigge (*33*) has found that certain *perfringens* toxins contain two components which correspond to those described by Henry (*21*). He has been able to separate partially these two fractions by precipitating with sodium sulfate and ammonium sulfate (*34*). Prigge has proposed the term "zeta toxin" for the nonhemolytic factor and "alpha toxin" for the hemolytic factor. Previously the term "alpha" had been proposed by Glenny et al. (*16*) for the toxin produced by the *Cl. perfringens* strains of human origin. They believed that the toxin was a single antigenic entity which was hemolytic for red blood cells, lethal for mice, and necrotic following intradermal injections into guinea pigs or rabbits.

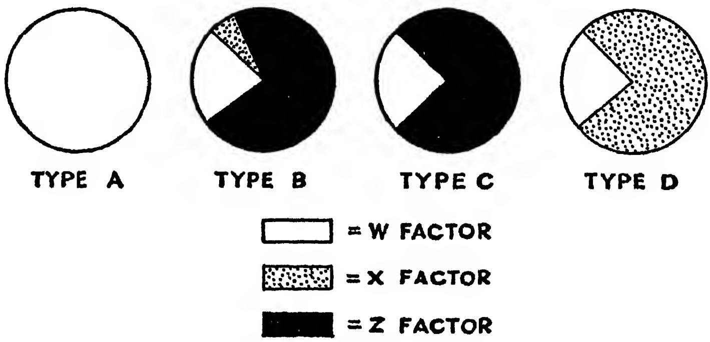
Until 1923 (*15*) only the toxins from strains isolated from human sources had been studied. With the investigation of strains isolated from animal sources the complexity of the toxic components became even more apparent. In 1928 Dalling (*9*) isolated the lamb dysentery bacillus which was found to be similar culturally and morphologically to Welch's organism. He showed, however, that his organism produced a highly potent toxin which was not neutralized by the antitoxin of the classical *perfringens* strains but that its antitoxin would neutralize the toxin of the human strains as well as its own toxin. About one year later, 1929 30, McEwen (*26*) isolated another *perfringens*-like organism which he named *Bacillus paludis*. This bacillus was isolated from sheep suffering from a disease of the enterotoxemia type called "struck." McEwen found that the toxin of his organism was not neutralized by the antitoxin of the *Cl. perfringens* strains of human origin nor would its antitoxin neutralize the toxins of these strains. Further investigations on the anaerobes concerned in diseases of sheep resulted in the isolation of a fourth *perfringens*-like organism. Bennetts (*3*), in 1932, isolated an organism from sheep dying of an enterotoxemia in West Australia. This organism differed

from the other known *perfringens* forms in its toxin, the toxin being neutralized only by its own specific antitoxin. Bennetts named this organism *Bacillus ovitoxicus.*

In 1931 Wilsdon (*51*) made a comparative study of the *perfringens*-like organisms and found that they could be classified according to their toxin-antitoxin reactions. He grouped them all as *Cl. perfringens* (*welchii*). Those of human origin, or the classical *Clostridium perfringens,* were designated as type A; the lamb dysentery organism, or *Bacillus agni,* as type B; *Bacillus paludis* strains as type C; and an organism isolated by himself from an enterotoxemia of sheep as type

FIGURE I

A SCHEMATIC REPRESENTATION OF THE ANTIGENIC COMPONENTS OF THE TOXINS OF THE FOUR TYPES OF CLOSTRIDIUM PERFRINGENS. (WILSDON)



D. Later he showed that his type D and Bennetts' *Bacillus ovitoxicus* were the same (*52*).

A schematic representation of the antigenic components of the toxins of the four types, as given by Wilsdon, is shown in figure 1.

The letter W represents the antigenic factor present in type A toxin. As this factor is present in the toxins of the other three types, the antitoxins of types B, C, and D are capable of neutralizing type A toxin, while type A antitoxin neutralizes only its own toxin. The type B toxin contains, in addition to the W factor, two other factors, Z and X, the Z factor being shared by type C toxin and the X factor by type D toxin. Because of the complexity of the B toxin its antitoxin is capable of neutralizing the toxins of all four types. The type C toxin containing only the two antigenic components Z and W is capable of inciting the production of an antitoxin which neutralizes only type A and type C toxins. Since type D toxin also contains the W factor

in addition to the X factor, its antitoxin is also capable of neutralizing type A toxin as well as its own. Wilsdon's work has been confirmed and extended by others (Glenny et al. (*16*), Borthwick (*4*), Weinberg and Guillaumie (*48*), and Duffett (*13*)).

Experimental

Cultures used.—The cultures used were as follows:

Type A strains:
- PB6H, isolated by Bull and Pritchett.
- SR12, received from Muriel Robertson.
- 1633, isolated by Torrey.

Type B strains:
- No. 34, Wilsdon's strain.
- The *Bacillus agni* of lamb dysentery, isolated from the intestinal content of a lamb (Hall collection).

Type C strains:
- No. 3628, Wilsdon's No. 51.
- The *Bacillus paludis* of McEwen (No. 40) (American Type Culture Collection).
- No. 108A, as above (Hall collection).

Type D strains:
- DR_2, Bennetts' strain R_2 of his *Bacillus ovitoxicus* (received from A. T. Glenny).

VARIATIONS OBSERVED IN THE NEUTRALIZING PROPERTIES OF THE AMERICAN STANDARD ANTITOXIN AS DETERMINED BY THE MOUSE PROTECTION TEST

By culturing under identical conditions, several lots of toxin were produced from three different strains of *Cl. perfringens* of human origin, PB6H, SR12, and 1633. These cultures were grown in glucose peptone beef infusion broth. Just before inoculation, the broth was heated in streaming steam for 1 hour to expel the air present, cooled rapidly, and then 0.25 percent glucose was added from a sterile 50 percent solution. Two-liter flasks of the broth were then inoculated with 6 cc. of the supernatant of a 24-hour meat culture. The broth cultures were then layered with sterile vaseline. These were incubated at 37° C. for 10 to 12 hours and then passed through Berkefeld N filters. The crude toxin filtrates were used in some of the tests; in others the toxins were precipitated with 70 percent ammonium sulfate and dried over phosphorus pentoxide. All the dried toxins used in this study were precipitated and dried in a similar manner.

The protection tests were carried out by the intravenous injection of mixtures of toxin and antitoxin into mice weighing 17 to 20 grams.

In order to determine the number of m. l. d. of each toxin neutralized, varying quantities of the toxin were added to a constant amount of antitoxin (0.2 unit). The mixtures were allowed to stand 1 hour at room temperature before being injected into animals.

A protocol of a representative test from one of a series is given in table 1.

TABLE 1.—*The neutralization of 3 different lots of type A Clostridium perfringens toxin by the American standard antitoxin*

Toxin	Amount of toxin	Amount of antitoxin	Number of mice injected	Deaths	Time of death
	M. l. d.	*Unit*			
SR12 filtrate, 0.05 cc = 1 m. l. d.	4	0.2	4	3	10 minutes to 1 hour
	7	.2	4	4	Immediately
	10	.2	4	4	Do.
	13	.2	4	4	Do.
	16	.2	4	4	Do.
1633 filtrate, lot I, 0.05 cc = 1 m. l. d.	4	.2	4	1	15 minutes.
	7	.2	4	3	15 minutes to 11 hours.
	10	.2	4	4	Immediately.
	13	.2	4	4	Do.
	16	.2	4	4	Do.
1633, lot II pptd. and dried, 0.2 mg = 1 m. l. d.	8	.2	6	0	
	11	.2	6	0	
	17	.2	6	0	
	14	.2	6	0	
	20	.2	6	2	3 hours
PB6H pptd. and dried, 0.6 mg = 1 m. l. d.	2.5	.2	6	1	1 hour
	5	.2	6	1	Do.
	7.5	.2	6	4	30 minutes to 1 hour.
	10	.2	6	6	5 to 15 minutes
	12.5	.2	6	5	Immediately.

A. FACTORS WHICH MIGHT INFLUENCE THE NATURE OF THE TOXIN PRODUCED BY A GIVEN STRAIN OF *Cl. perfringens*, TYPE A

1. PERIOD OF INCUBATION

Tests were carried out to determine the effect of the period of incubation as a factor governing the production of a toxin component which is not neutralized by the antitoxin. Three 2-liter flasks of peptone beef infusion broth containing 0.25 percent glucose were heated and cooled as above and then each inoculated with 6 cc. of a 24-hour meat culture of strain SR12. These were incubated at 37° C. for 8, 11.5, and 20 hours. The cultures were then filtered and the toxins precipitated and dried as above. The m. l. d. of each toxin was determined in mice and subsequently tested against the standard antitoxin.

The three toxins were found to be neutralized equally well and with no irregularities. As many as 20 m. l. d. of each toxin were neutralized by 0.2 unit of the antitoxin. This is shown in table 2.

The differences observed in the neutralization of the toxin in this test and in the test shown in table 1 could not be explained on the basis of the data in this preliminary experiment. However, a partial explanation is presented in later experiments dealing with the

hemolysins. It may also be that certain of the toxin components vary in their stability and that precipitating with ammonium sulfate may alter the toxins.

TABLE 2.—*Period of incubation as a factor in the production of a toxin component not neutralized by the standard antitoxin*

SR12 precipitated toxin			Standard antitoxin	Number of mice inoculated	Deaths
Period of incubation	Percent glucose in medium	M. l. d. of toxin			
			Unit		
8 hours	0.25	8	0.2	3	0
		11	.2	3	0
		17	.2	3	0
		20	.2	3	1
11.5 hours	0.25	8	.2	3	0
		11	.2	3	0
		17	.2	3	0
		20	.2	3	2
20 hours	0.25	8	.2	3	0
		11	.2	3	0
		17	.2	3	0
		20	.2	3	2

2. COMPOSITION OF THE MEDIUM

(*a*) *Cysteine content.*—Orr and Reed (*30*) have shown that the addition of 0.1 percent or more of cysteine to chopped meat medium markedly inhibited the production of hemotoxin by *Cl. perfringens* and that hydrogen sulfide has a similar effect. They showed that the effect was related to the metabolism of the organism and not to a direct reaction with the formed toxin. The addition of these concentrations of cysteine was shown to produce a marked drop in the oxidation-reduction potential of cultures during the most active growth period. There were no observable differences in the rate of growth or of the maximum growth obtained. The presence of hemotoxin was determined by titrating against washed sheep red blood corpuscles. No mention is made of the toxicity of the cultures.

Since peptones of different makes differ in their sulfhydryl content as determined by the sodium nitroprusside test, tests were carried out to determine the effect of different peptones, with and without added cysteine, on the hemolysins produced. Four different peptones were tested. These were used in amounts of one percent in beef infusion broth. Cysteine hydrochloride was added in amounts giving 0.015 percent and 0.15 percent concentrations. The media were tubed and sterilized by heating at 15 pounds pressure for 20 minutes. *Cl. perfringens* types A, B, C, and D were grown in the above media for 24 hours at 37° C. and the cultures were then centrifugalized. The supernatant fluid of each was then tested for hemolysins.

Hemolysin titrations of toxins produced in the different peptone media.—All titrations for hemolysins in this study were carried out identically. Five percent suspensions of washed sheep, rabbit, mouse, and human red blood cells were used in 0.5-cc. amounts. Varying quantities of toxin were added to the cells and these were then made up to a volume of 1 cc. with physiological saline. The toxin and red blood corpuscles were incubated for 1 hour at 37° C. and then read for the presence of hemolysis. The least amount of toxin producing complete hemolysis was designated as the minimum hemolyzing dose (m. h. d.).

The results on the hemolysin titrations of the type A toxins produced in the different peptone media are given in table 3.

The results on the hemolysins for the type C toxins were very similar to those of the type A toxins. Types B and D were only slightly hemolytic when grown in the media which gave good hemolysins with types A and C.

TABLE 3.—*The effect of the peptone and of the peptone plus cysteine on hemolysin production by Clostridium perfringens, types A and C*

Peptone	Amount of filtrate	Sheep r. b. c.		Rabbit r. b. c.		Mouse r. b. c.		Human r. b. c.	
		Type A	Type C	Type A	Type C	Type A	Type C	Type A	Type C
	Cc								
Bacto	0.5	++++	++++	++++	++++	++++	++++	++++	++++
	0.2	++++	++++	++++	++++	++++	++++	++++	++++
	0.1	++++	++++	++++	++++	++++	++++	++++	++++
	0.05	+++	+++	+++	+++	+++	+++	+++	+++
Bacto+0.015 percent cysteine.	0.5	++++	++++	++++	++++	++++	++++	++++	++++
	0.2	++++	++++	++++	++++	++++	++++	++++	++++
	0.1	++++	++++	++++	+++	++++	++++	++++	++++
	0.05	++	++	+++	+++	+++	+++	+++	+++
Bacto+0.15 percent cysteine	0.5	++++	++++	++++	++++	+++	+++	+++	+++
	0.2	+++	+++	++++	++++	+++	+++	+++	+++
	0.1	+++	+++	+++	+++	++	++	++	++
	0.05	++	++	+++	++	+	+	+	+
Parke-Davis	0.5	++++	++++	++++	++++	++++	++++	++++	++++
	0.2	+++	+++	+++	+++	+++	+++	+++	++
	0.1	++	++	++	++	++	++	++	++
	0.05	+	+	+	+	++	++	+	+
Parke-Davis+0.015 percent cysteine.	0.5	+++	++	+++	+++	+++	+++	+++	+++
	0.2	++	++	++	++	++	++	++	++
	0.1	++	+	++	++	++	++	++	++
	0.05	+	+	+	+	+	+	+	+
Parke-Davis+0.15 percent cysteine.	0.5	+++	++	+++	+++	+++	+++	+++	+++
	0.2	++	++	++	++	++	++	++	++
	0.1	+	+	+	+	+	+	+	+
	0.05	+	+	+	+	+	+	+	+
Proteose	0.5	+++	+++	+++	+++	+++	+++	+++	+++
	0.2	++	++	++	++	++	++	++	++
	0.1	++	+	++	++	++	+	++	++
	0.05	+	+	+	+	+	+	+	+
Proteose+0.015 percent cysteine.	0.5	++	++	++	++	++	++	++	++
	0.2	+	+	+	+	+	+	+	+
	0.1	−	−	−	−	−	−	−	−
	0.05	−	−	−	−	−	−	−	−
Proteose+0.15 percent cysteine.	0.5	+	+	+	+	+	+	+	+
	0.2	+	+	−	−	−	−	−	−
	0.1	−	−	−	−	−	−	−	−
	0.05	−	−	−	−	−	−	−	−

TABLE 3.—*The effect of the peptone and of the peptone plus cysteine on hemolysin production by Clostridium perfringens, types A and C*—Continued

Peptone	Amount of filtrate	Sheep r. b. c.		Rabbit r. b. c.		Mouse r. b. c.		Human r. b. c.	
		Type A	Type C	Type A	Type C	Type A	Type C	Type A	Type C
	Cc.								
Witte	0.5	++++	++++	++++	++++	++++	++++	++++	++++
	0.2	++++	++++	++++	++++	++++	++++	++++	++++
	0.1	++++	++++	++++	++++	++++	++++	++++	++++
	0.05	++++	++++	++++	++++	++++	++++	++++	++++
Witte+0.015 percent cysteine	0.5	++++	++++	++++	++++	++++	++++	++++	++++
	0.2	++++	+++	++++	++++	++++	++++	++++	++++
	0.1	+++	++	+++	+++	+++	+++	+++	+++
	0.05	++	+	++	++	++	++	++	++
Witte+0.15 percent cysteine.	0.5	++++	+++	++++	++++	++++	+++	+++	+++
	0.2	+++	+++	+++	+++	+++	+++	+++	+++
	0.1	+	+	++	+	++	+	++	++
	0.05	−	−	−	+	+	−	+	+

No marked differences in the hemolytic action of the toxins for the different types of red blood cells were observed. However, differences in the amount of hemolysin formed in the different media were noted. Cultures in the proteose peptone medium gave the poorest hemolysins; proteose peptone plus cysteine hydrochloride almost completely inhibited its production. Berkefeld filtrates of type A proteose cultures containing no hemolysin were tested for toxicity and found to be lethal for mice, indicating the presence of a nonhemolytic toxin component. The toxicity was comparatively low, the m. l. d. for a mouse being from 0.1 cc. to 0.5 cc. when inoculated intravenously.

(*b*) *Meat in the medium.*—The toxin of *Cl. perfringens* has been shown to be readily destroyed in an acid medium. Walbum and Reymann (*40*) have found that a potent toxin could be produced by culturing the organism in peptone veal broth if calcium carbonate were added to keep the pH from becoming too low. Meat has also been used in the medium because of its buffer effect (*2*).

In this study the meats that were used were ground beef heart, ground beef, and ground veal which had been extracted with water for the preparation of infusion broth. In order to use equivalent amounts of each, they were first thoroughly dried under a current of hot air. Each meat preparation was then tested for its buffer effect in the medium and for toxin production. The media were prepared by adding 10 percent of the dried meat to a peptone (any of the well-known brands) beef infusion broth and then adjusting the reaction so the pH after sterilizing would be about 7.8. The medium was sterilized by heating at 20 pounds pressure for 30 minutes.

Bacto beef, a commercial dried powdered meat preparation, was also used in broth. This was used in amounts of 2 to 2.5 percent. The media were prepared as above.

To study the toxin production, flasks of the above media were heated in streaming steam to expel the air and then cooled rapidly and 0.25 percent glucose from a sterile 50 percent solution was added. These were inoculated with a 24-hour culture of the strain under investigation. The cultures were incubated 16 to 20 hours at 37° C. After cultivation the pH was recorded, the cultures centrifugalized and filtered through Berkefeld N candles. The m. l. d. and hemolytic titration were then determined as above.

With all the above media very good toxins were produced with the strains used from the four types of *Cl. perfringens* However, with type D culture 48 to 72 hours' incubation was required. The pH was in no instance below 6.0–6.2 after the period of cultivation. Only the specific results with the type A strains will be given as this is the chief toxin with which we are here concerned. It may be mentioned, however, that with the other three types very similar results were obtained.

Dried beef heart, beef, and veal in the medium all gave the same results so these will be grouped together as ground meat. This medium yielded toxins with an m. l. d. of 0.0125–0.025 cc. for a 17 to 20 gram mouse when inoculated intravenously. Such toxins were not markedly hemolytic. When tested against sheep red blood cells they were practically nonhemolytic if the readings were made after 1 hour incubation at 37° C. (0.5 cc. of the toxin filtrate giving about a 1 plus hemolysis). If the titrations were read after standing 24 hours at room temperature or in the refrigerator slightly more lysis was observed. Rabbit and human red blood cells were slightly more susceptible to the lysin of this toxin. However, when mouse red blood cells were used in the titrations, hemolysis was very pronounced. The hemolytic action of this toxin will be referred to its action on sheep red blood cells.

Toxins produced in the Bacto beef medium were also found to have high potencies. The m. l. d. of such toxin was often below 0.01 cc. for mice injected intravenously. These toxins were found to be highly hemolytic for all four types of red blood cells employed, mouse red blood cells being the least susceptible.

Decided differences in the rapidity of action of the two toxins have been observed. Toxins produced in meat medium and low in hemolysin for sheep red blood cells were found to be considerably slower in killing than toxins high in hemolysin for sheep red blood cells.

Table 4 gives the results of *in vitro* hemolytic titrations and of the lethal action of the two toxins produced by a single type A strain of *Cl. perfringens* when grown in the two media described above.

TABLE 4.—*Titration of two type A toxins produced by the same culture in different media*

Amount of toxin (cc.)	Hemolysin titration: Sheep r. b. c.	Rabbit r. b. c.	Human r. b. c.	Mouse r. b. c.	Toxicity for mice: Amount toxin (cc.)	Mice inoculated
	Toxin filtrate from a type A peptone beef infusion broth culture containing 10 percent dried meat					
0.5	+	++++	++++	++++	0.5	Died.
0.2	+	+++	+++	++++	.2	Do.
0.1	−	++	++	++++	.1	Do.
0.05	−	+	±	++++	.05	Do.
0.025	−	±	−	+++±	.025	Do.
0.0125	−	−	−	++	.0125	Do.
0.006	−	−	−	+	.006	Lived.
	Toxin filtrate from a type A Bacto beef peptone beef infusion broth culture					
0.1	++++	++++	++++	++++	0.5	Died.
0.04	++++	++++	++++	++++	.2	Do.
0.02	++++	++++	++++	++++	.1	Do.
0.01	++++	++++	++++	++++	.05	Do.
0.005	++++	+++	++	++	.025	Do.
0.0025	+++	+	+	±	.0125	Do.
0.001	+	−	−	−	.006	Lived.

The marked differences in the toxins produced in the Bacto beef medium and in the ground meat medium were found, as indicated below, to be due to the presence of lipoid substances in the ground meat. Fifty grams of dried ground veal were finely pulverized and one-half was extracted with ether and alcohol, the method for extracting beef heart for the Kahn antigen (*22*) being used. The veal with the lipoids extracted was then dried and made up into medium using 10 percent of the defatted veal in peptone beef infusion broth, and the pH adjusted to 7.8. As a control the ground veal which had not been extracted with ether and alcohol was made up into medium in the same manner as the defatted veal. Types A and C *Cl. perfringens* were grown in both of these media for 16 hours and then filtered and the filtrate tested for hemolysins.

Both the type A and the type C grown in the defatted veal medium produced toxins with strong hemolysins for sheep, rabbit, and mouse red blood cells, while the filtrates of the cultures grown in the veal medium with the veal that had not been defatted were nonhemolytic for sheep red blood cells, only slightly hemolytic for rabbit red blood cells, but definitely hemolytic for mouse red blood cells. This is shown in table 5.

In order to determine whether the lipoid substances inhibited hemolysin production, or merely masked the hemolysin present, or acted in some way to protect the sheep, rabbit, and human red blood cells, the supernatant fluids of centrifuged cultures grown in ground veal medium were thoroughly extracted with ether and tested

for hemolysins. The toxin remained nonhemolytic for sheep red blood cells and only slightly hemolytic for rabbit and human red blood cells. Reduction with sodium sulfite did not activate hemolysis. Hemolytic controls extracted in like manner remained hemolytic.

TABLE 5.—*The effect of lipoids on hemolysin production by Clostridium perfringens types A and C*

Medium	Amount of culture filtrate used, cc.	Sheep r. b. c.	Rabbit r. b. c.	Mouse r. b. c.
	Type A toxin			
10 percent ground lean veal in beef infusion peptone broth	0.5	+	++	++++
	.2	−	+	++++
	.1	−	−	++++
	.05	−	−	+++±
	.025	−	−	++
Same as above, only the ground veal was extracted with ether and alcohol	.1	++++	++++	++++
	.04	++++	++++	+++
	.02	++++	++++	+
	.01	++++	+++	−
	.005	+++	++	−
	Type C toxin			
10 percent ground lean veal in beef infusion peptone broth	0.5	+	++	++++
	.2	−	+	++++
	.1	−	±	+++
	.05	−	−	++
	.025	−	−	+
Same as above, only ground veal was extracted with ether and alcohol	.1	++++	++++	++++
	.04	++++	++++	+++
	.02	+++	++++	+++
	.01	+++	+++	±
	.005	++	++	−

From these results it appears that the lipoids either inhibit the formation of hemolysin for sheep red blood cells or in some way alter it.

(*c*) *Glucose in the medium.*—Several investigators have found that when *Cl. perfringens* is grown in a medium containing glucose a toxic substance which is not neutralized by the antitoxin is formed. Kojima (*24*) found that this "nonspecific toxin" was directly correlated with the percentage of glucose in the medium, being produced when the sugar content is high, the line of division being fairly constant at 0.5 percent glucose. Walbum and Reymann (*40*) found that it was not formed in measurable quantities in media containing 0.75 percent glucose. However, with a content of 2.25 percent glucose it was formed in considerable quantity.

In our work three type A strains, SR12, PB6H, and 1633, were grown in flasks of peptone beef infusion broth containing glucose in the following percentages: 0.25, 0.5, 1.0, 2.0, and 2.25. These were

incubated 12 hours, filtered through Berkefeld N candles, and the toxin filtrates tested for their m. l. d. Neutralization of these toxins was then determined by testing against two different antitoxins, one high in antihemolysin and the other low in antihemolysin as determined by titrations against toxins highly lytic for sheep red blood cells. (This will be shown in the section on the antigenic relationship of the hemolysins.)

As seen in table 6 all the toxins, even those produced in media containing a high percentage of glucose, were neutralized by antitoxin 229. With antitoxin AS_1 no protection was given against the toxins produced in the medium containing 1 or 2 percent glucose; as few as 2.5 m. l. d. were not neutralized. However, when this same antitoxin was tested against the toxins made in the media containing 0.25 and 0.5 percent glucose the mice were protected. Antitoxin AS_1, as contrasted with antitoxin 229, had very little antihemolysin for the lysin for sheep red blood cells.

TABLE 6.—*The neutralization of the "nonspecific" toxin produced by Cl. perfringens (PB6II) when grown in a media containing different percentages of glucose*

Toxin				Antitoxin			Toxicity for mice	Time of death (minutes)	Hemolytic action of toxin-antitoxin mixtures on red blood corpuscles			
Percent glucose	M. h. d. for sheep r. b. c. (cc.)	Amount (cc.)	Number m. l. d.	Number	Amount (cc.)	Dil.			Sheep	Mouse	Rabbit	Human
0.25	0.02	0.05	2.5	229	0.2	1:2	Lived		−	−	−	−
		.125	5.0	229	.2	1:2	do		−	−	−	−
		.25	10.0	229	.2	1:2	do		−	−	−	−
.5	.04	.025	2.5	229	.2	1:2	do		−	−	−	−
		.05	5.0	229	.2	1:2	do		−	−	−	−
		.1	10.0	229	.2	1:2	do		−	−	−	−
1.0	.1	.25	2.5	229	.2	1:2	do		−	−	−	−
		.5	5.0	229	.2	1:2	do		++	−	±	+
		1.0	10.0	229	.2	1:2	Died	90	+++	+	+++	+++
2.0	.1	.25	2.5	229	.2	1:2	Lived		−	−	−	−
		.5	5.0	229	.2	1:2	do		−	−	−	−
		1.0	10.0	229	.2	1:2	do		++	−	++	++
.25	.02	.05	2.5	AS_1	.2	1:25	do		+++	±	+++	+++
		.125	5.0	AS_1	.2	1:25	do		++++	±	++++	++++
		.25	10.0	AS_1	.2	1:25	do		++++	±	++++	++++
.5	.04	.025	2.5	AS_1	.2	1:25	do		+++	−	+++	+++
		.05	5.0	AS_1	.2	1:25	do		++++	±	++++	++++
		.1	10.0	AS_1	.2	1:25	do		++++	+	++++	++++
1.0	.1	.25	2.5	AS_1	.2	1:25	Died	20	++++	++	++++	++++
		.5	5.0	AS_1	.2	1:25	do	10	++++	+++	++++	++++
		1.0	10.0	AS_1	.2	1:25	do	1	++++	++++	++++	++++
2.0	.1	.25	2.5	AS_1	.2	1:25	do	40	++++	++	++++	++++
		.5	5.0	AS_1	.2	1:25	do	30	++++	+++	++++	++++
		1.0	10.0	AS_1	.2	1:25	do	5	++++	++++	++++	++++

Longer periods of incubation appear to have little effect on the production of a "nonspecific toxin." Cultures grown in meat medium or broth with added calcium carbonate, containing 2.25 percent glucose and incubated for 20, 24, 30, 36, and 41 hours, showed very little toxicity. In some instances 0.5 cc. was found to kill mice instantly when inoculated intravenously but the toxin was neutralized by antitoxin.

B. THE ANTIGENIC RELATIONSHIP OF THE HEMOLYSINS

In order to determine the toxicity and the antigenicity of the two hemolysins prepared in the different media, antitoxins were prepared against the two toxins. Rabbits were immunized against the toxins of types A, B, C, and D *Cl. perfringens*, using strongly hemolytic filtrates from peptone beef infusion broth cultures and Bacto beef cultures and with filtrates from cultures grown in ground meat medium which were nonhemolytic for sheep red blood cells.

Formalinized toxins (0.3 percent formaldehyde added and then incubated for 48 hours at 37° C.) were used for immunizing the rabbits. In order to assure good antihemolytic titers in the sera, when the rabbits had reached a fair degree of immunity, fresh toxin filtrates were used instead of the formalinized toxins. A total of 36 injections was given to each rabbit. Two rabbits were immunized against each toxin as follows:

Rabbit	Strain	Type	Medium
243	PB6H	A	Ground meat medium.
67	PB6H	A	Do.
229	PB6H	A	Peptone beef infusion broth and Bacto beef.
235	PB6H	A	Do.
164	108A	C	Ground meat medium.
244	108A	C	Do.
86	108A	C	Peptone beef infusion broth and Bacto beef.
241	108A	C	Do.
171	34	B	Ground meat medium.
181	34	B	Do.
18	34	B	Peptone beef infusion broth and Bacto beef.
16	34	B	Do.
226	DR_1	D	Ground meat medium.
286	DR_1	D	Do.
11	DR_1	D	Peptone beef infusion broth and Bacto beef.
15	DR_1	D	Do.

1. SPECIFICITY OF ANTIHEMOLYSINS

The antigenic relationship of the two hemolysins was determined by hemolytic titrations and by mouse intravenous inoculations of toxin-antitoxin mixtures. Each rabbit antiserum was tested against the two hemolysins produced by the homologous type. The hemolytic titrations and the protection tests were carried out as in the previous experiments. Two mice were used to each dose of toxin-antitoxin mixture. The size of the inoculum was kept to 1 cc. when possible.

It was found that antitoxins 235 and 229 which were prepared by immunizing with strongly hemolytic type A toxins gave complete protection against both hemotoxins of type A. Antitoxins 67 and 243 prepared by immunizing with the toxins that were not lytic for sheep red blood cells neutralized only their homologous toxins. The results are given in table 7.

TABLE 7.—*The antigenic relationship of the two types of hemolysins as determined by hemolytic titration with sheep red blood cells and by neutralization of the lethal effect*

Antitoxin number, 0.2 cc of 1:10 dilution	Type A hemolytic toxin			Type A toxin, nonhemolytic for sheep r. b. c.		
	Amount toxin, m. l. d.	Hemolysin for sheep r. b. c.	Protection for mice	Amount toxin, m. l. d.	Hemolysin for sheep r. b. c.	Protection for mice
67	2	++	Lived	2	−	Lived.
	4	++++	Died	4	−	Do.
	8	++++	do	8	−	Do.
	16	++++	do	16	−	Do.
243	2	++++	do	2	−	Do.
	4	+++	do	4	−	Do.
	8	++++	do	8	−	Died.
	16	++++	do	16	−	Do.
235	2	−	Lived	2	−	Lived.
	4	−	do	4	−	Do.
	8	−	do	8	−	Do.
	16	−	do	16	−	Do.
	20	−	do	20	−	Do.
229	2	−	do	2	−	Do.
	4	−	do	4	−	Do.
	8	−	do	8	−	Do.
	16	−	do	16	−	Do.
	20	−	Died	20	−	Died.

The results were similar with types B, C, and D toxin-antitoxin mixtures. With types B, C, and D, as with type A, if the hemolysins produced in the broth cultures were not neutralized by the antitoxin, the toxin-antitoxin mixtures were toxic for mice when inoculated intravenously. The type B and D toxins of the strains used were never highly hemolytic for sheep red blood cells so the differences in the hemolytic and nonhemolytic toxins were not as pronounced as with the types A and C strains. These tests show the importance of producing antitoxins which have antihemolysins for the different types of hemolysins produced by *Cl. perfringens.*

2. HEMOLYSIN ABSORPTION AS FURTHER EVIDENCE OF THE SPECIFICITY

Toxin filtrates from ground meat cultures, broth cultures and Bacto beef cultures were absorbed with stroma from sheep, rabbit, and mouse red blood cells prepared according to the method of Pascucci (*32*). The absorption of the hemolysins was carried out by incubating 40 m. h. d. of the toxins with 50 milligrams of the different dried stroma. (The m. h. d. was determined with sheep red blood cells for the broth and Bacto beef toxins, while mouse red blood cells were used for the toxin produced in the ground meat medium.) The stroma and toxin were incubated overnight at 10° C., then one hour at 37° C. The toxins were then centrifugalized in order to remove the stroma and the clear supernatant tested for lysins present for sheep, rabbit, and mouse red blood cells.

The results of the hemolysin absorption tests of the three type A toxins are given in table 8.

TABLE 8.—*Absorption of the hemolysins of type A toxins with dried pulverized stroma of rabbit, mouse, and sheep red blood cells (40 m. h. d. of toxin + 50 mg. stroma)*

Medium used for producing the toxin	Red blood cell stroma	Hemolytic titrations		
		Sheep red blood cells	Rabbit red blood cells	Mouse red blood cells
Broth	Sheep	−	±	−
	Rabbit	−	±	+
	Mouse	−	±	+
Ground meat	Sheep	−	+±	++++
	Rabbit	−	+±	++++
	Mouse	−	+±	++++
Bacto beef	Sheep	−	++±	++++
	Rabbit	−	++±	++++
	Mouse	−	++±	++++

The hemolysin present in broth culture filtrates was absorbed out by each of the three different types of red blood cell stroma used, the filtrate becoming nonhemolytic for all three types of cells. The absorption was nonspecific; that is, the lysin for sheep red blood cells was absorbed out by rabbit, mouse, and sheep red blood cell stroma. The same was true of the hemolysin for the rabbit and mouse red blood cells.

With the toxins prepared in the Bacto beef medium, which also had hemolysins for all three types of red blood cells, only the hemolysin for the sheep red blood cells was completely absorbed out, this absorption being nonspecific as all three types of red blood cell stroma removed it. The hemolysins for the mouse and the rabbit red blood cells were only partially absorbed.

The hemolysin of the toxin filtrates from cultures in ground meat medium differed from the hemolysin in the broth cultures in that it was not absorbed by red blood cell stroma. Only a very slight absorption was noted in testing for the hemolysin for rabbit red blood cells, while with mouse red blood cells no absorption appears to take place with any red blood cell stroma. The hemolysin was not removed even when the number of m. h. d.'s was decreased to 5 m. h. d. and the red blood cell stroma increased to 100 milligrams.

The same results were obtained with the hemolysins of types B, C, and D toxin filtrates.

C. THE NATURE OF THE TOXIN COMPONENTS OF *Clostridium perfringens* TYPE A

1. THE INACTIVATION OF THE HEMOLYSINS BY FILTRATION

Inactivation of hemolysins as a result of filtration through Seitz filters has been observed by Chopra and Roy (7). They explained the inactivation as due to the surface action of the asbestos which eliminates the active principle by adsorption or by altering its nature

altogether. A similar inactivation of the hemolysins of *Cl perfringens* has been observed in our work as a result of filtering through collodion or cellophane membranes.

Filtration of the toxin of *Cl. perfringens* through graded membranes will be discussed in another communication.

Membranes through which hemolytic toxins had been filtered and which had completely removed the hemolysins from the filtrate were washed in a small volume of saline, about one-fourth that of the toxin filtered, and the washings tested for hemolysin. Although slight hemolytic activity could be demonstrated it was never of the original titer. Attempts to recover the hemolysins by grinding the mem branes or by eluting, using buffers with a range from pH 5.0 to pH 9.4, were negative.

It was found that complete inactivation of the hemolysins on the membrane could be brought about by filtering a quantity of physiological saline through the membrane after filtering the toxin, thus washing it free of the broth present.

2 ACTIVATION OF THE HEMOLYSINS

The inactive hemolysins on the membrane could be recovered by washing the membrane in a small amount of physiological saline. This, as well as the first filtrate (the broth filtrate), was nonhemolytic. However, it was found that if the two were mixed, the mixture became hemolytic. This suggested the possibility of a cohemolysin in the filtrate. A similar activation of the hemolysins recovered from the membrane was produced by adding broth or 0.05 percent cysteine hydrochloride. The addition of two amino acids without SH groups, glycine and alanine, did not bring about an activation. It may be assumed, therefore, that the activation is due to a reduction of the hemolysins or that the hemolysins are capable of bringing about a lysis of red blood cells only when in a reduced medium. That the activation is due to a reduction either of the hemolysins or of the medium in which suspended can be further shown by bubbling oxygen through an active preparation. This procedure was found completely to inactivate the hemolysins, the reaction being reversible.

The activation of enzymes with reducing substances such as hydrogen cyanide, hydrogen sulfide, or organic substances containing sulfhydryl groups in the reduced form has been extensively studied (*18, 28, 39, 41, 43*). Hellerman, Perkins, and Clark (*20*) believe that the phenomenon associated with the reversible inactivation of some enzymes is due to a direct action of the sulfhydryl groups of the enzyme itself; the enzyme in its reduced form, for example En-SH, being active while the En-S-S-En oxidized form is inactive.

A reversible inactivation of hemolysins similar to that described for enzymes has also been shown. Neill (*29*) found that pneumococcal

hemolysin which had been inactivated by air or hydrogen peroxide may be reactivated by the use of reducing substances. Shwachman, Hellerman, and Cohen (*37*) showed that the pneumococcal hemolysin is active when reduced and may be reversibly inactivated by operations that are known to convert sulfhydryl compounds to the corresponding dithio derivatives or to mercaptides.

If an enzyme or a hemolysin possesses SH groups which determine its activity the active form of a purified enzyme or hemolysin might be expected to give a positive nitroprusside test and the inactive form to become activated on the addition of hydrogen cyanide.

In testing the effect of hydrogen cyanide on *perfringens* hemolysin it was found that at pH 7.0 concentrations of 0.025, 0.05, and 0.1 percent had no effect on the activation of the hemolysin inactivated by filtration. Concentrations of 0.1 and 0.05 percent were found to be inhibitory to the action of active hemolysin but 0.025 percent had no effect. Hydrogen cyanide has been shown to have an inhibitory effect on certain enzymes (*36, 38*). Results of the activation of *perfringens* hemolysin are given in table 9.

TABLE 9.—*The action of activating substances on the hemolysin inactivated by filtering through a cellophane membrane*

Hemolysin	Dilution	Amount, cc.	Hemolytic activity		
			Sheep r. b. c.	Rabbit r. b. c.	Mouse r. b. c.
Hemolysin separated from broth by filtration, recovered with saline.	Undiluted	0.5	−	−	−
		.2	−	−	−
		.1	−	−	−
		.05	−	−	−
Above+nonhemolytic filtrate	1:1	.5	++++	++++	++++
		.2	++++	++++	++++
		.1	++++	++++	+++
		.05	++	++	+
Above hemolysin+broth	1:1	.5	++++	++++	++++
		.2	++++	++++	++++
		.1	++++	++++	+++
		.05	++	++	+
Above hemolysin+0.05 percent cysteine hydrochloride.	Undiluted	.5	++++	++++	++++
		.25	++++	++++	++++
		.1	++++	++++	+++
		.05	++	++	+
Above hemolysin+0.05 percent KCN +0.025 percent KCN.	do	.5	−	−	−
		.5	−	−	−
Original active hemolysin+0.05 percent KCN+0.025 percent KCN.	do	.5	−	−	−
		.5	++++	++++	++++

3. A NONHEMOLYTIC TOXIN COMPONENT

At times the filtration of *Cl. perfringens* type A toxins through collodion membranes resulted in the separation of a toxin component in the filtrate which was nonhemolytic for rabbit, mouse, and sheep red blood cells as determined by *in vitro* titrations. This toxin was lethal

for mice, the m. l. d. being from 0.1 cc. to 0.5 cc. It was impossible to obtain consistent results. The production and filtration of the nonhemolytic component is dependent upon factors not yet determined.

Discussion

The variations observed in the neutralizing properties of certain *Cl. perfringens* type A antitoxins when tested against different lots of type A toxins appear to be due to differences in the composition of the toxins. The nature of the toxin produced by a given strain has been shown to be dependent on the medium.

Recently Dalling and Ross (*12*), in studying the factors influencing the production of the various toxins of the *Cl. perfringens* group, have shown the importance of meat in the production of the epsilon factor (Glenny et al.) or Wilsdon's X factor by types D and B cultures. They found that an epsilon toxin of high value could be obtained by culturing in a medium with 50 percent meat by volume and that with type B cultures it was practically negligible in the absence of meat.

Since the medium used in culturing the *Cl. perfringens* group determines to a large extent the toxin components formed, the stability of the types is also more or less influenced by the medium. Dalling (*11*) has reported a type B which became permanently altered so that it lost its capacity to produce the epsilon factor, and so became toxicogenically a type C. Dalling and Ross (*12*) have reported a type C which at times failed to produce any beta toxin (Glenny et al.). It differed from the type A cultures in that it produced a delta hemolysin (Glenny et al.) as well as the alpha toxin. Borthwick (*5*) has described the conversion of a type D to a type A.

A résumé of the toxin components which have been described for the toxins of the *Cl. perfringens* group is as follows:

Type A.—Alpha toxin (Glenny et al.) or the W factor (Wilsdon); this is hemolytic, lethal, and necrotic; and a zeta (Prigge) or nonhemolytic toxin factor.

Type B.—Alpha toxin; beta toxin (Glenny et al.), or the Z factor (Wilsdon); this is lethal and necrotic; a gamma toxin (Glenny et al.) and an epsilon toxin (Glenny et al.), or the X factor (Wilsdon). The gamma and epsilon toxins are also lethal and necrotic.

Type C.—Alpha, beta, gamma, and a delta toxin (Glenny et al.). The delta fraction is a hemolysin and is believed to be nontoxic.

Type D.—Alpha and epsilon factors.

In this study, although many of the details remain to be worked out, our results show that the toxin of *Cl. perfringens* type A when produced under suitable conditions is a complex substance made up of at least three components, two hemotoxins and a nonhemolytic toxin. The production of *Cl. perfringens* type A antitoxins with antibodies for all the toxin components depends on the use of a toxin pro-

duced in a medium which yields all the toxin components. A medium made with 10 percent dried defatted ground meat or 2.0 to 2.5 percent Bacto beef in a peptone beef infusion broth has been found suitable for this purpose.

The factors which influence the production of the nonhemolytic toxin have not been determined. Its presence as determined by filtration through collodion and cellophane membranes was quite irregular. This irregularity of the nonhemolytic toxin in the filtrates may have been due to differences in the physical properties of the membranes; some may have retained it along with the hemolysins while others allowed it to pass; or it may be that the nonhemolytic toxin is formed only after a definite period of growth and is unstable. Nonhemolytic filtrates which were toxic could not be made hemolytic by reducing, using the usual methods of reduction. The two other toxin components, the hemotoxins, may be reversibly inactivated. The lytic activity of the hemolysins appears to be controlled by the state of oxidation of either the lysins themselves or of the medium in which they are suspended. When the hemolysins were completely separated from the broth in which they were suspended they lost all their lytic activity. On the addition of the nonhemolytic filtrate to the inactivated hemolysins the lytic property of the hemolysins returned. Broth and cysteine hydrochloride were found to have the same activating effect. The activation of the hemolysin may have been due to one of the following reactions: (1) The addition of sulfhydryl groups to the hemolysin, (2) a reduction of the sulfhydryl groups in the hemolysin, (3) a reduction of the medium in which the hemolysin was suspended. It was not determined which reaction took place. It was shown, however, that potassium cyanide added to the inactive hemolysin did not activate it or give a positive nitroprusside test showing that the S-S groups were changed to SH groups. It may be added, however, that this test has been reported as not altogether reliable in testing for the thiol group (*37*).

The hemolysin that is lytic for sheep red blood cells seems to be the less stable of the two hemotoxins. Under certain conditions precipitating with ammonium sulfate appears to inactivate the hemolysin to a marked degree.

The "nonspecific" toxin resulting from the cultivation of *Cl. perfringens* type A in media containing from 1 to 2.25 percent glucose was found to be neutralized by antitoxins which had high antihemolytic titers.

Summary

Cl. perfringens type A has been shown to produce at least three different toxin components which are dependent on the type of medium used for culturing the organism. Two of the components are hemotoxins which can be separated by absorption on dried red blood cell

stroma and by filtration. One is lytic for sheep red blood cells while the other has little action on them after 1 hour's incubation at 37° C. These two hemotoxins were shown to be antigenically different. Lipoids were found to inhibit the formation of the hemotoxin which is lytic for sheep red blood cells.

The hemotoxins may be reversibly inactivated by separating them from the broth in which they are suspended or by bubbling oxygen through the active hemolysins. The hemotoxins may be separated from the broth by filtering through collodion membranes. Activation of the hemolysins can be brought about by introducing substances containing SH groups.

A nonhemolytic toxin component was found in some of the type A filtrates. It was possible to separate this toxin from the hemolysins by filtering through graded membranes.

The "nonspecific toxin" resulting from the cultivation of *Cl. perfringens* type A in media containing from 1 to 2.25 percent glucose was found to be neutralized by antitoxins having high antihemolytic titers for the two types of hemolysins.

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THE EXPERIMENTAL PATHOLOGICAL CHANGES PRODUCED BY THE TOXIN OF *CLOSTRIDIUM HISTOLYTICUM* IN ANIMALS[1]

By JOSEPH G. PASTERNACK, *Passed Assistant Surgeon*, and IDA A. BENGTSON, *Senior Bacteriologist, United States Public Health Service*

A study of methods suitable for the standardization of *Clostridium histolyticum* antitoxin (*1*) and experimental work in the production of a potent *histolyticum* toxin (*2*) afforded us an opportunity to study the pathological changes produced by the toxin in a large number of mice, guinea pigs, rabbits, and rats.

In addition to the marked proteolytic effects possessed by the toxin, Stewart (*2*) has demonstrated a strong hemolysin in 2 percent glucose broth cultures of the micro-organism.

The anaerobe *Cl. histolyticum* was first described by Weinberg and Seguin (*3*) in 1916 in a study of the bacterial flora of war wounds. It is a Gram positive, motile, spore-forming, somewhat pleomorphic

[1] From the Pathologic Service, U. S. Marine Hospital, New Orleans, La., and the Division of Infectious Diseases, National Institute of Health.

organism. The spores are oval, occurring in the subterminal position and swelling the rod. It is less strictly anaerobic than other anaerobic organisms of the gas gangrene group, growing to a slight extent on the surface of plain agar and blood agar. Carbohydrates are not fermented. Milk, coagulated albumen, blood serum, brain and meat media are digested. Tyrosin crystals occur in meat media cultures. The organism is remarkable for its rapid lytic action on living tissue, which is in marked contrast to its slower action on nonliving tissue. This property is exhibited by the bacteria-free filtrate as well as by cultures, though to a lesser extent. The active lytic action on living tissue has suggested the experimental use of filtrates in the treatment of malignant growths, but no conclusive results have thus far been obtained.

The subcutaneous or intramuscular inoculation of cultures or filtrates induces the well-known, rapidly progressing local lesion in guinea pigs as described by Weinberg and Seguin (*3*), Nasta (*4*), and Combiesco (*5*).

The experimental pathological changes produced by the specific toxin of *Clostridium histolyticum* in animals have not been previously reported.

The reports of Nasta (*4*) and Combiesco (*5*) describe the local lesion in guinea pigs following subcutaneous and intramuscular inoculation of whole cultures of the organism.

Their observations agree in regard to the rapid and progressive swelling of the part, the intense edema that dissects and tears apart the tissues, and the purplish discoloration of the skin and hemorrhagic liquefaction of the soft parts. The digestive process may clean the bone of soft tissue, and spontaneous amputation of the limb may result. The animals may die in 12 to 24 hours, or linger for days in fairly good health and die of secondary infection.

Nasta (*4*) traced the evolution of the lesion in the thigh muscle of guinea pigs over a period of hours. He observed that the lytic effects spread far beyond the distribution of the micro-organism itself. Obviously this was due to the permeation of the toxin produced by the organism. He was of the opinion that the toxin had a specific and elective affinity for voluntary muscle tissue.

Beckwith and MacKillop (*6*) first entertained the idea that the toxin may be absorbed into the circulation and thereby produce lytic phenomena in tissues of the body distant from the site of inoculation of the organism. They inoculated whole cultures of the organism into the gluteal muscles of a small group of guinea pigs and after 48 hours autopsied them. They make no mention of gross findings. Histologic examination of the kidneys, liver, spleen, lungs, adrenal glands, and heart disclosed foci of liquefaction necrosis, exudation of fibrin, and hemorrhage in some of the animals.

The present report is based on the gross observation and microscopic study of 135 mice, 56 rats, 78 guinea pigs, and 40 rabbits. Many more animals were actually utilized, but they were discarded because they died during the night or showed intercurrent infection.

About 75 percent of the animals were inoculated intravenously with toxin alone or with various mixtures of toxin and antitoxin. The remainder received variable doses of potent toxin subcutaneously or intramuscularly.

The toxin used for inoculating the animals was prepared by incubating cultures in meat infusion broth made with Witte's peptone of a reaction of pH 7.4 to 7.6 for 13½ hours, filtering, and precipitating with ammonium sulfate.

The variation in length of survival of animals receiving approximately the same doses of toxin afforded an opportunity to observe the effects of the toxin after different time intervals.

All tissues were fixed in Orth's fluid. Sections were stained with Weigert's acid iron chloride hematoxylin and Van Gieson's picrofuchsin, and with a buffered Romanowsky stain (7). The latter stain is especially valuable for studying early and slight retrograde degenerative changes. Fibrin was stained according to Weigert. Herxheimer's rapid (Sudan IV) method was used to demonstrate fatty changes in the viscera.

PATHOLOGICAL CHANGES IN GUINEA PIGS, RABBITS, RATS, AND MICE AFTER INTRAVENOUS INOCULATION

Gross examination.—Only occasional animals showed gross lesions.

In 5 guinea pigs that died after 28, 45, 46, 80, and 117 hours, the following lesions were present, respectively: Petechial hemorrhages in both kidneys; hemorrhagic infarction of part of the spleen; bilateral hemorrhagic necrosis of the adrenal glands; intense pulmonary edema; and miliary focal necroses of the liver.

Three rabbits that died after 24, 30, and 51 hours showed, respectively, petechial hemorrhages of the kidneys, hemorrhagic pneumonia of the left lung, and foci of hepatic necrosis.

There were no demonstrable gross lesions in the mice and rats.

Microscopic examination.—Microscopic lesions in one or more organs were found in 56 percent of the mice, 33 percent of the rats, 69 percent of the guinea pigs, and 65 percent of the rabbits.

Spleen: This organ showed degenerative changes more regularly than any other. All of the mice that survived 12 hours or longer, about one-half of the guinea pigs that survived over 36 hours, about one-third of the rabbits that lived over 36 hours, and a few of the rats showed some type of lesion.

Congestion of the pulp was frequently present and frank hemorrhages that obscured the architecture were occasionally seen. Occasionally the sinuses were intensely distended with serous or serosanguinous fluid. In 5 mice and 3 guinea pigs foci of pulp thrombosis were seen, and in 1 guinea pig there was massive hemorrhagic infarction.

Hemolysis and degenerative changes in the red blood cells were seen in animals that survived 3 to 4 days. Considerable quantities of free and phagocytosed hemosiderin were frequently present.

Pyknosis and karyorrhexis of the lymphocytes in the Malpighian corpuscles and pulp was the most frequent lesion. This degenerative change was present in various degrees. Variable numbers of follicles showed pyknosis and fragmentation of their lymphoid cells. Not infrequently several or many follicles were converted into collections of nuclear debris, among which large, pale reticulum cells filled with nuclear fragments were present.

The pulp lymphocytes showed degenerative changes less often. Occasionally the pulp was edematous, considerably depleted of lymphocytes and contained macrophages filled with nuclear debris. These clear areas might be interpreted as foci of liquefaction, but the stroma was intact and there was no evidence of tissue necrosis other than degenerative changes in the lymphocytes.

In all of the animals, but more particularly in rabbits, collections of polymorphonuclear leucocytes were demonstrable when advanced degenerative changes were present.

The progress of the intoxication had no notable effect on the number of megakaryocytes present. They fluctuated considerably in various stages in all animals. Frequently they showed nuclear pyknosis and hyalin or hydropic degeneration of the cytoplasm.

Fibrin was demonstrated in occasional areas of pulp thrombosis and hemorrhage.

Rather frequently the central arterioles showed complete hyalinization of their wall. A similar change was also present in the arteries of several guinea pigs. The endothelial lining was absent in these blood vessels.

Kidneys: Lesions of some type were present in all of the animals that received the larger doses of toxin and survived over 24 hours. Roughly, the degree and extent of the renal damage was proportional to the survival time.

The degenerative changes affected principally the convoluted tubules and ascending limbs of Henle's tubules. The epithelium of these tubules showed all grades of swelling, granular and hydropic degeneration. Albuminous coagulum was frequently present in the lumen.

Some degree of colloid droplet degeneration was present in the majority of the animals. This varied from minute eosinophilic hyaline droplets more or less intermingled with the cytoplasmic granules, to large coarse colloid droplets that ruptured the epithelium and escaped into the lumen of the tubules. Fusion of these droplets resulted in the hyalin casts that were seen in many tubules. Rarely minute fat droplets were demonstrated in the epithelium.

Necrosis of tubular epithelium was present in an occasional animal. This lesion varied from increased cytoplasmic oxyphilia and pyknosis of isolated epithelial cells or groups of cells, to massive coagulation necrosis of segments of tubules. Extensive necrosis was rarely seen.

Specimens that showed considerable tubular degeneration occasionally showed scattered glomerular lesions. Desquamation of the capsular epithelium, serous coagulum in the capsular space, and rarely collections of erythrocytes were present. Hyalin thrombi were found in segments of occasional loops and rarely partial thrombonecrosis of a glomerular loop was encountered.

Rather frequently there was marked congestion of the blood vessels, moderate interstitial edema, focal hemorrhages deep in the cortex, with only minor degenerative changes in occasional tubules.

The capillaries and larger blood vessels occasionally showed deposits of hemosiderin in their wall but no lesions.

Heart: Lesions were present in 19 mice, 5 guinea pigs, and 4 rabbits.

Irregular interstitial edema of moderate severity and scattered small focal interstitial hemorrhages were present. Segments of muscle fibers and groups of fibers showed swelling, hydropic or coarse granular degeneration, and more or less deformity. Necrobiotic lesions were not found. Fat droplets were not demonstrable within muscle fibers.

Liver: Animals that died in less than 50 hours rarely showed lesions. The Kupffer cells were frequently filled with hemosiderin. Occasionally marked diffuse congestion was present. Scattered foci of necrosis of hepatic cells were found in 10 percent of the animals. These consisted of small scattered foci of coagulation necrosis. The hepatic cells in these areas showed various degrees of cytoplasmic oxyphilia and nuclear pyknosis, or hyalin eosinophilic coagulation and karyolysis. Occasionally hyalin or fibrin thrombi were demonstrable in these areas. The larger foci of necrosis were frequently associated with hemorrhage and hematogenous pigmentation of the bordering hepatic cells.

In the rabbits the more advanced foci of necrosis were infiltrated by polymorphonuclear leucocytes.

Lymph nodes: Lymph nodes from various regions of a small number of animals were examined. The tracheobronchial and mesenteric nodes showed moderate congestion and edema. Occasionally small

foci of pyknosis and karyorrhexis of lymphocytes were seen. Macrophages filled with nuclear debris were present in the sinuses.

Adrenal glands: Mice and rats rarely showed significant pathologic changes. About one-third of the guinea pigs and about 10 percent of the rabbits showed some type of lesion.

Moderate interstitial edema, congestion, and scattered hemorrhages in the cortex were present. In a few of the animals large disrupting hemorrhages were seen at the junction of cortex and medulla, and occasionally in the medulla. Necrobiotic lesions were present in a few of the animals. In some there were isolated cells or cell cords in the cortex that showed nuclear pyknosis and fragmentation, or coagulation necrosis with complete karyolysis. In a few animals large areas of coagulation and hemorrhagic necrosis were present throughout the cortex. Occasionally hyalin and fibrin thrombi were demonstrable in these areas. In rabbits, the foci of advanced necrosis were usually infiltrated by degenerating and fragmenting polymorphonuclear leucocytes.

Pancreas: There were no significant pathologic changes in 74 specimens examined.

Testes: The 33 specimens examined showed no lesions that could be assigned to the toxin.

Ovary: The 21 specimens examined showed no changes that could be assigned to the toxin.

Urinary bladder: The urinary bladder of 2 guinea pigs showed moderate submucous edema and interstitial hemorrhage. This lesion was identical with lesions seen in guinea pigs on vitamin C deficient diets.

Skeletal muscle: There were no demonstrable lesions.

Brain and spinal cord: The brain and cord were examined in 10 mice, 5 guinea pigs, 5 rabbits, and 3 rats that had received large doses of toxin and survived over 50 hours. Significant lesions were not demonstrable in these specimens.

Lungs: About 12 percent of the guinea pigs and rabbits and a few of the mice and rats showed significant lesions. These consisted of intense vascular engorgement, serous exudate in aggregates of alveoli, diapedesis of variable numbers of red blood cells into scattered alveoli, and occasionally frank alveolar hemorrhages. Necrobiotic lesions were not found.

Bone marrow: The vertebral or sternal marrow of 65 animals was studied after decalcification. Animals that survived over 50 hours showed moderate grades of edema, small scattered focal hemorrhages, and pyknosis of scattered cells or groups of cells. In one guinea pig that lived 59 hours the sternal marrow showed advanced necrosis of large aggregates of marrow cells.

Thymus gland: Edema and congestion were present in 5 of the 11 specimens examined.

PATHOLOGICAL CHANGES IN MICE, RATS, GUINEA PIGS, AND RABBITS PRODUCED BY THE SUBCUTANEOUS AND INTRAMUSCULAR INOCULATION OF TOXIN

Local lesion.—Mice were given from 0.025 to 0.2 cc. and the other animals 0.25 to 2 cc. of the toxin. Mice and rats were resistant to the action of the toxin; rabbits and guinea pigs were moderately susceptible. With the smaller subcutaneous doses, mice and rats showed no reaction or slight swelling, redness, and loss of hair over the area of inoculation after 2 to 5 days. With the largest doses the reaction was more marked and in a small percentage of the animals there was hemorrhagic discoloration of the skin. Incision of the skin after various intervals showed more or less hemorrhagic edema of the subcutis. The process did not extend into the underlying muscle and there was no sloughing of the skin.

Guinea pigs and rabbits usually showed redness of the skin and moderate swelling 2 to 4 days after inoculation of the toxin. With the largest doses the skin frequently showed hemorrhagic discoloration and more or less sloughing after 4 to 7 days.

Deep intramuscular inoculation of large doses of toxin into mice and rats produced slight to moderate swelling of the part, redness of the skin, and loss of hair in about half the group inoculated. The reaction usually reached its height in 3 to 6 days and then subsided. Incision of the part at the height of the reaction showed edema and congestion of the subcutis, and edema, softening, and redness of the muscle. Minor degrees of myolysis were occasionally present.

With the largest doses, guinea pigs and rabbits usually showed spreading boggy edema of the part and purplish discoloration of the skin in 3 to 4 days. Fluctuation of the swelling rapidly developed and in the majority of animals the skin broke by the fifth or sixth day and beet-soup-like fluid escaped. After this fluid escaped, most of the animals recovered. In some, however, the skin did not break until the swelling involved most of the limb and a considerable part of the abdomen. Spontaneous rupture usually occurred on the sixth or seventh day with the escape of the digested fluid tissue. In these cases the bones were frequently exposed. Evisceration occurred in several animals due to liquefaction necrosis of the abdominal wall. In several animals spontaneous amputation at the hip or knee joint occurred. However, the animals showed only slight systemic reaction until death.

Microscopic examination.—Animals were sacrificed at various intervals in order to study the evolution of the local lesion.

Three hours after subcutaneous inoculation of the toxin there was usually marked edema of the entire subcutis. After 8 hours the interstices were greatly enlarged and the subcutaneous pattern was entirely lost, the fibers being separated and torn apart. The epidermis was undermined by fluid and separated from the dermis; glands, blood vessels, and nerves were separated from all supporting tissue and appeared to "float" free in the fluid. Islets of adipose tissue were pushed apart. In some areas small numbers of blood cells were seen, but in others frank hemorrhages were present. The larger blood vessels showed edema of the wall with more or less separation of its elements. Nerves showed interstitial edema.

After 24 hours the epidermis showed hydropic degeneration and dissociation of the epithelial cells. The collagen and elastic fibrils showed swelling, fusion, and pseudocolloid degeneration. The glands showed hydropic degeneration of the cytoplasm of the cells, karyolysis, and desquamation. Here and there the wall of blood vessels showed moderate to marked hydropic degeneration and loss of nuclear staining of the cell structures. Beginning infiltrations of polymorphonuclear leucocytes were present in some areas of edema. This was more prominent in guinea pigs and rabbits. Actual thrombosis of blood vessels was rarely seen.

The essential lesion was the rapidly developing edema. This apparently is an attempt on the part of nature to dilute the intensely irritating and proteolytic effect of the toxin.

Following intramuscular inoculation a similar dissecting and disorganizing edema develops. In the first few hours the process extends along the muscle planes, later the muscle bundles are separated, and finally the individual fibers show irregular swelling and deformity, loss of transverse striation, and changes or complete loss in staining quality. In some bundles only vacuoles are present where there were fibers, and individual fibers often show segmental vacuolation. Despite these changes in the muscle cells the nuclei rarely showed significant alteration.

Myolysis progresses with relatively little associated hemorrhage for the first 24 hours, but later there is considerable hemorrhage and liberation of blood pigment. Moderate infiltrations of polymorphonuclear leucocytes occur as myolysis proceeds.

The smaller blood vessels showed hydropic and hyaline degeneration of the wall, but large vessels rarely showed pathologic changes.

After subcutaneous inoculation of the toxin, only an occasional guinea pig showed minor degenerative changes in the spleen and kidneys.

After intramuscular inoculation, a few of the mice showed degenerative changes in the spleen. None of the rats showed lesions. The guinea pigs and rabbits that showed advanced and extensive local

lesions showed minor to moderate degenerative changes in the spleen, kidneys, and lungs. Pulmonary edema and pulmonary hemorrhages occurred more frequently in this group of animals than in those inoculated intravenously.

SUMMARY

The anaerobe *Clostridium histolyticum* produces a powerful proteolytic toxin and hemolysin. Rats and mice are relatively resistant to the action of the toxin, while guinea pigs and rabbits are moderately susceptible.

Subcutaneous inoculations of the toxin produce only minor changes in rats and mice. Guinea pigs and rabbits usually show redness of the skin and moderate swelling in 2 to 4 days. With large doses there is more or less hemorrhagic discoloration and sloughing.

Deep intramuscular inoculation of large doses of toxin into mice and rats produced minor degrees of swelling and occasionally myolysis. Guinea pigs and rabbits showed a spreading boggy edema, hemorrhagic necrosis of the skin, and severe myolysis. In some animals there was complete denudation of the bone and spontaneous amputation at the hip or knee joint. However, the animals showed only slight systemic reaction.

The essential lesion is a rapidly developing edema that disorganizes and separates the tissues. In the first few hours the edema extends along the muscle planes, later the muscle bundles are separated, and finally the individual fibers show irregular swelling and deformity, loss of transverse striation, and alteration in staining quality. In some bundles only vacuoles are present where there were fibers, and individual fibers often show segmental vacuolation.

Myolysis is associated with more or less hemorrhage and hemolysis. The smaller blood vessels show degenerative changes of the wall, but large ones rarely show lesions.

The variation in survival time of animals receiving approximately the same doses of toxin intravenously afforded an opportunity to observe the effects of the toxin after different time intervals.

Gross lesions were rarely present. Microscopic lesions were found in 56 percent of the mice, 33 percent of the rats, 69 percent of the guinea pigs, and 65 percent of the rabbits.

The spleen showed degenerative changes more regularly than any other organ, and the kidneys were next.

In the spleen the important lesion was pyknosis and karyorrhexis of the lymphocytes in the Malpighian corpuscles. The conversion of follicles into heaps of nuclear debris and phagocytosis of the fragments by reticulum cells was characteristic.

The kidneys showed granular, hydropic, and colloid droplet degeneration of the tubular epithelium. Occasionally groups of cells or stretches of the epithelium showed coagulation necrosis. Rarely thrombonecrosis of segments of a tuft were present. Interstitial edema and focal hemorrhages were seen in some animals.

In a small number of animals the heart showed moderate interstitial edema and scattered small focal hemorrhages.

Focal necroses in the liver were present in 10 percent of the animals.

The adrenals in an occasional animal showed focal necrosis and hemorrhages.

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NEW CANCER FILM AN IMPORTANT EDUCATIONAL FEATURE

A two-reel sound film illustrating the techniques of modern treatment of cancer by X-rays, radium, and surgery, and dramatizing the saving of life which may be brought about by early diagnosis and treatment, has recently been produced by the United States Public Health Service and the American Society for the Control of Cancer.

The film, entitled "Choose to Live," is an educational feature designed for showing to the general public, and is not only informative but should prove most effective in stimulating persons with suspicious symptoms to seek prompt diagnosis.

The dramatic interest centers in the story of a young mother who fears the symptom which she is concealing from her family but, through dread of what may be revealed, postpones for a time a consultation with her physician. She is prompted to consult her doctor, however, by a lecture on cancer which she hears at her club. In the lecture a doctor tells the story of the fight against cancer, discusses the symptoms which demand attention, and summarizes his talk with the words, "One should not take a chance, for early cancer can be cured."

Mary Brown heeds the warning, consults her family physician, learns that her worst fears are confirmed, and promptly enters the

hospital for an operation. The condition was discovered early, and in a gratifyingly short time Mary returns to her home and family, thankful that she heeded the advice that brought her to her physician. Fortunately for the many prospective victims of the dread disease, "early cancer can be cured."

The film is of high professional standard, produced by skilled technicians, and with the important parts played by professional actors. Interesting shots include the laboratories of the National Institute of Health, 250,000- and 1,000,000-volt X-ray machines in action, the filling of tubes with radon, the use of radium applicators, and other modern procedures. The accompanying musical score is an original arrangement played by members of the National Broadcasting Co. Symphony Orchestra.

The film runs approximately 18 minutes. Prints are available in both 35-mm. and 16-mm. sizes. All have sound recording, which necessitates the use of a projection machine with sound equipment.

A limited number of prints is available on loan from the Public Health Service, the borrower to pay all transportation costs. Local health departments and voluntary health agencies are urged to suggest to their local theater managers that the film be included in their programs. It is suggested that local health departments purchase a copy of the 16-mm. print of the film, if possible, for continued use in their communities. Copies may be purchased from the United States Public Health Service at the actual cost of printing. The prices are $14.68 for the 16-mm. and $32.36 for the 35-mm. print.

All inquiries should be addressed to the Surgeon General, United States Public Health Service, Washington, D. C.

COURT DECISION ON PUBLIC HEALTH

"Sanitary tax" in connection with privies upheld.—(South Carolina Supreme Court; *Town of Marion* v. *Barley*, 5 S.E.2d 573; decided November 13, 1939.) A regulation of a town board of health provided that every head of a family in the town having in use a sanitary closet or privy should be liable for an annual sanitary tax of $3. This regulation was also adopted as an ordinance of the town, which ordinance made a violation of the regulation punishable by a fine or imprisonment. A resident of the town was convicted for not paying the sanitary tax and he appealed to the supreme court. Such court affirmed the judgment appealed from, and some of the court's conclusions may be briefly stated as follows:

(*a*) The evident purpose of the regulation was to impose an inspection or service charge upon the designated class for the service rendered and privilege permitted, and the constitutional requirement that taxes

levied must be uniform in respect to persons and property had no application.

(*b*) The regulation was valid and in its adoption the board of health acted within the scope of its delegated powers to protect and preserve the public health.

(*c*) In adopting the ordinance the town acted within the scope of the powers delegated to it by the legislature, and the enforcement of the ordinance by fine or imprisonment was not violative of any of the constitutional provisions relied on by the defendant.

DEATHS DURING WEEK ENDED APRIL 13, 1940

[From the Weekly Health [illegible] of the Census, Department of Commerce]

	Week ended Apr. 13, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,693	8,852
Average for 3 prior years	8,908	
Total deaths, first 15 weeks of year	140,9[illegible]	140,092
Deaths under 1 year of age	497	518
Average for 3 prior years	553	
Deaths under 1 year of age, first 15 weeks of year	7,755	8,237
Data from industrial insurance companies:		
Policies in force	65,810,905	67,540,043
Number of death claims	13,144	17,483
Death claims per 1,000 policies in force, annual rate	10.4	13.5
Death claims per 1,000 policies, first 15 weeks of year, annual rate	10.7	11.5

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED APRIL 27, 1940

Summary

The telegraphic reports for the current week reveal what is probably the beginning of the sharp spring rise of Rocky Mountain spotted fever in the western States. Eleven cases were reported in 5 western States, 4 of which occurred in Montana. While these preliminary reports are not complete, the sharp rise suggests that it is time for health officers, in areas in which this disease occurs, to issue precautionary measures for the public. The rise of the seasonal curve and the peak of Rocky Mountain spotted fever incidence occur much earlier in the western States than in the East.

For the week ended April 27, the incidence of each of the 9 important communicable diseases listed in the following table, with the exception of influenza, was below the 5-year (1935–39) median expectancy; and the cumulative totals for the first 17 weeks of the year ended with the current week were below the 5-year medians for the corresponding period for all of the 9 diseases except influenza and poliomyelitis.

As a further indication of the favorable health conditions so far this year, the total number of deaths in 88 large cities for the first 16 weeks ended April 20 was 149,774 as compared with 149,959 in 1939 and with 142,364 in 1938. In 1938, which year recorded the lowest general death rate for the United States, the mortality in large cities was exceptionally low during the month of February.

Telegraphic morbidity reports from State health officers for the week ended April 27, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Apr. 27, 1940	Apr. 29, 1939		Apr. 27, 1940	Apr. 29, 1939		Apr. 27, 1940	Apr. 29, 1939		Apr. 27, 1940	Apr. 29, 1939	
NEW ENG.												
Maine	0	1	0	-------	99	6	597	57	72	1	1	0
New Hampshire	0	0	0	-------	-------	-------	15	81	31	0	0	0
Vermont	0	0	0	-------	-------	-------	6	78	78	0	0	0
Massachusetts	3	4	4	-------	-------	-------	118	1,028	667	2	1	8
Rhode Island	3	0	0	-------	-------	-------	188	26	72	0	0	0
Connecticut	0	0	2	1	3	4	41	1,009	464	0	0	0
MID ATL.												
New York	24	17	30	[1] 16	[1] 25	[1] 15	812	1,705	2,927	0	4	13
New Jersey	6	12	16	10	5	8	608	69	1,211	2	0	3
Pennsylvania	28	38	34	-------	-------	-------	330	128	1,113	12	6	6
E. NO. CEN.												
Ohio	7	20	20	54	-------	27	25	82	1,080	1	0	8
Indiana	4	9	9	8	25	21	16	23	332	0	2	2
Illinois	19	43	35	9	60	60	104	86	282	3	2	7
Michigan [2]	2	15	11	14	36	3	674	420	420	0	2	8
Wisconsin	1	0	1	52	115	40	543	705	765	2	0	2
W. NO. CEN.												
Minnesota	0	4	8	-------	6	-------	120	461	382	0	0	0
Iowa	3	7	7	-------	7	6	430	187	187	0	0	1
Missouri	8	2	11	4	1	56	13	16	40	0	2	4
North Dakota	1	1	0	9	26	14	14	45	40	0	0	0
South Dakota	0	1	0	2	9	-------	1	821	5	1	0	0
Nebraska	0	6	5	-------	22	-------	17	622	137	0	0	0
Kansas	8	12	9	8	18	18	630	95	95	0	0	1
SO. ATL.												
Delaware	0	0	0	-------	-------	-------	0	0	17	0	0	0
Maryland [2]	2	2	4	8	18	9	2	848	330	1	1	4
Dist. of Col.	8	4	9	-------	-------	1	1	292	75	0	2	2
Virginia	9	20	12	175	262	-------	184	656	584	0	1	5
West Virginia [2]	14	7	10	55	100	54	15	10	123	3	2	4
North Carolina	4	7	10	14	17	17	135	716	321	0	1	2
South Carolina [3]	4	9	5	270	548	264	12	17	44	0	0	1
Georgia [3]	10	6	6	28	344	53	68	132	0	0	0	1
Florida	2	5	4	9	8	2	99	107	74	0	0	0
E. SO. CEN.												
Kentucky	4	6	10	42	18	16	86	19	405	0	1	10
Tennessee	4	8	4	64	133	59	127	60	60	0	1	6
Alabama [3]	5	8	10	93	515	93	176	178	178	2	1	6
Mississippi	1	5	6	-------	-------	-------	-------	-------	-------	1	0	0
W. SO. CEN.												
Arkansas	4	6	6	92	157	63	30	132	42	0	1	1
Louisiana [3]	8	8	12	12	21	21	12	141	49	0	4	0
Oklahoma	2	2	8	85	107	60	21	186	115	3	1	1
Texas [3]	22	19	31	387	757	479	1,260	406	249	1	2	3
MOUNTAIN												
Montana [4]	1	2	2	4	14	14	40	173	49	0	0	1
Idaho [4]	0	1	0	-------	7	2	87	133	29	0	1	0
Wyoming [4]	3	2	1	1	-------	-------	15	153	42	0	0	0
Colorado [5]	9	9	7	9	14	-------	26	470	356	0	0	0
New Mexico	1	1	8	-------	2	1	80	28	42	0	0	0
Arizona	2	1	2	96	69	86	89	85	54		0	0
Utah [3, 4]	1	2	0	10	13	-------	750	93	23		1	0
PACIFIC												
Washington	0	1	1	-------	-------	-------	702	980	327	0	0	0
Oregon [4]	4	2	2	9	44	29	603	75	75	1	0	1
California	11	25	26	68	81	74	397	2,393	1,606	0	0	4
Total	247	355	406	1,718	3,736	1,698	10,315	15,087	15,087	36	40	149
17 weeks	5,970	7,885	9,308	159,244	138,406	126,658	116,620	226,989	220,989	671	854	2,312

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 27, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Apr. 27, 1940	Apr. 29, 1939		Apr. 27, 1940	Apr. 29, 1939		Apr. 27, 1940	Apr. 29, 1939		Apr. 27, 1940	Apr. 29, 1939	
NEW ENG.												
Maine	0	0	0	10	12	11	0	0	0	0	1	0
New Hampshire	0	0	0	2	0	6	0	0	0	0	1	1
Vermont	0	0	0	13	7	7	0	0	0	1	0	0
Massachusetts	0	1	0	166	185	216	0	0	0	3	3	2
Rhode Island	0	0	0	6	15	19	0	0	0	0	2	0
Connecticut	0	0	0	119	93	93	0	0	0	3	0	1
MID. ATL.												
New York	2	0	0	977	538	834	0	0	0	9	8	8
New Jersey	0	1	0	306	236	236	0	0	0	6	1	3
Pennsylvania	1	1	1	476	370	539	0	0	0	7	10	9
E. NO. CEN.												
Ohio	1	0	1	505	519	442	0	27	0	3	3	6
Indiana	0	0	0	217	173	173	3	47	10	1	2	1
Illinois	0	1	1	818	483	725	3	25	19	11	3	4
Michigan [2]	3	1	0	326	436	412	4	13	5	4	3	3
Wisconsin	0	1	0	97	184	289	2	0	7	4	2	1
W. NO. CEN.												
Minnesota	0	0	0	72	88	182	3	17	5	1	0	0
Iowa	0	0	0	66	116	166	26	71	40	1	1	2
Missouri	0	1	1	37	73	161	8	18	18	1	2	4
North Dakota	0	0	0	13	12	30	3	7	8	0	0	1
South Dakota	0	0	0	14	15	19	0	7	7	0	0	0
Nebraska	0	0	0	19	54	54	0	8	19	0	0	0
Kansas	0	0	0	75	68	105	0	1	13	1	0	1
SO. ATL.												
Delaware	0	0	0	11	6	6	0	0	0	0	0	0
Maryland [3]	0	0	0	32	48	75	0	0	0	2	0	1
Dist. of Col.	0	0	0	30	18	18	0	0	0	0	0	0
Virginia	0	0	0	33	30	30	0	0	0	0	0	5
West Virginia [3]	0	0	0	52	39	41	0	0	0	0	1	8
North Carolina	0	0	0	32	22	23	1	0	1	0	5	2
South Carolina [3]	0	8	1	2	2	2	0	0	0	2	6	4
Georgia [3]	0	3	0	6	5	6	0	0	0	3	1	3
Florida	0	0	0	7	5	5	1	0	0	0	0	2
E. SO. CEN.												
Kentucky	0	0	0	83	42	40	1	1	0	2	2	4
Tennessee	0	1	0	74	53	27	0	6	1	0	0	2
Alabama [3]	0	3	1	12	8	6	1	3	2	4	0	4
Mississippi	1	0	0	9	0	3	0	0	0	0	4	3
W. SO. CEN.												
Arkansas	0	0	0	5	6	6	3	11	4	0	4	1
Louisiana [3]	0	1	1	5	20	11	0	0	1	6	13	13
Oklahoma	0	0	0	12	15	24	1	43	3	0	4	4
Texas [3]	2	0	0	20	37	30	6	13	4	5	8	8
MOUNTAIN												
Montana [4]	0	0	0	20	17	17	0	4	7	1	0	1
Idaho [4]	0	0	0	7	4	9	0	8	5	1	5	1
Wyoming [4]	0	0	0	8	5	7	0	0	2	1	0	0
Colorado [5]	0	0	0	44	34	62	1	0	2	0	0	0
New Mexico	0	0	0	23	22	24	1	4	0	1	0	1
Arizona	0	1	0	6	15	15	0	4	0	1	7	1
Utah [2 4]	0	0	0	13	26	32	2	1	1	0	0	0
PACIFIC												
Washington	0	0	0	41	35	35	0	1	12	0	2	2
Oregon [4]	0	0	0	11	26	32	0	6	16	1	1	1
California	3	4	3	133	169	170	6	17	17	5	1	6
Total	13	28	21	5,170	4,386	6,904	76	303	363	91	112	129
17 weeks	412	292	347	81,757	86,301	117,155	1,235	6,150	5,485	1,346	1,951	1,951

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 27, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended Apr. 27, 1940	Whooping cough, Week ended Apr. 29, 1939
NEW ENG.		
Maine	16	24
New Hampshire	40	4
Vermont	0	23
Massachusetts	150	220
Rhode Island	9	93
Connecticut	82	70
MID. ATL.		
New York	332	486
New Jersey	113	278
Pennsylvania	215	354
E. NO. CEN.		
Ohio	257	220
Indiana	37	60
Illinois	114	202
Michigan [2]	196	180
Wisconsin	80	170
W. NO. CEN.		
Minnesota	41	44
Iowa	29	15
Missouri	4	10
North Dakota	16	5
South Dakota	0	4
Nebraska	3	16
Kansas	43	21
SO. ATL.		
Delaware	5	6
Maryland [1]	140	25
Dist. of Col	22	83
Virginia	31	79
West Virginia [1]	35	18
North Carolina	76	293
SO. ATL.—continued		
South Carolina [3]	20	81
Georgia [3]	5	26
Florida	32	37
E. SO. CEN.		
Kentucky	84	14
Tennessee	32	36
Alabama [3]	18	39
Mississippi	----------	----------
W. SO. CEN.		
Arkansas	33	15
Louisiana [3]	63	23
Oklahoma	9	0
Texas [3]	318	146
MOUNTAIN		
Montana [4]	4	4
Idaho [4]	7	4
Wyoming [4]	0	1
Colorado [5]	16	66
New Mexico	144	42
Arizona	31	15
Utah [2, 4]	134	57
PACIFIC		
Washington	81	37
Oregon [4]	20	12
California	455	217
Total	3,542	3,837
17 weeks	51,872	69,070

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Apr. 27, 1940, 18 cases as follows: South Carolina, 1; Georgia, 5; Alabama, 4; Louisiana, 2; Texas, 6.
[4] Rocky Mountain spotted fever, week ended Apr. 27, 1940, 11 cases as follows: Montana, 4; Idaho, 1; Wyoming, 2; Utah, 3; Oregon, 1.
[5] Colorado tick fever, week ended Apr. 27, 1940, Colorado, 1 case.

VENEREAL DISEASES

New Cases Reported for February 1940 [1]

Reports from States

	Syphilis									Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All syphilis [3]					
	Primary and secondary	Early-latent [3]	Rate per 10,000 population	Includes late latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population
Alabama [4]													
Alaska								8		25			
Arizona	86	14	1.20	29	.69	13	0.31	190	4.76	163	3.90	4	0.10
Arkansas	171	140	1.54	204	.98	15	.07	1,074	5.18	181	.87	5	.02
California		[5] 345	.55	1,176	1.88	72	.12	1,652	2.69	1,213	1.99	10	.03
Colorado	30		.28	74	.60	6	.06	110	1.02	60	.56		
Connecticut	15	10	.14	70	.40	7	.04	155	.89	97	.55		
Delaware	4	13	.65	10	.88	9	.34	156	5.93	31	1.18		
District of Columbia								542	8.52	220	3.60	2	.03
Florida	23	370	2.31	865	5.00	59	.35	1,437	8.40	183	1.08	14	.08
Georgia	1,007	692	3.52					1,789	5.75	84	.27	15	.05
Hawaii	4	3	.02	36	.00	3	.01	66	.16	41	.10		
Idaho	12		.24	[6] 37	.74	3	.06	57	1.14	23	.46	2	.04
Illinois	123	351	.60	1,160	1.47	69	.09	1,703	2.15	1,026	1.30	23	.03
Indiana	91	40	.38	216	.62	18	.06	490	1.40	111	.32	1	.002
Iowa [4]													
Kansas	52	29	.43	60	.32	14	.08	231	1.24	75	.40		
Kentucky	107	87	.49	341	1.15	26	.09	623	2.11	252	.85	2	.01
Louisiana	439	1	2.05	1	.01	8	.04	761	3.55	76	.35	18	.08
Maine	10		.12	40	.47	9	.10	59	.60	40	.46	1	.01
Maryland	67	16	.49	131	.78	6	.04	627	3.72	180	1.12	20	.12
Massachusetts	71		.16	[6] 311	.70	23	.05	405	.91	291	.66		
Michigan	96	114	.43	302	.62	35	.07	720	1.48	499	1.02	20	.04
Minnesota	12	15	.11	178	.67	9	.03	214	.80	231	.86		
Mississippi	262	673	4.58	520	2.50	56	.27	3,679	18.03	2,363	11.58		
Missouri								235	.58	30	.07	1	.002
Montana	10		.18	18	.33	1	.02	36	.66	26	.48		
Nebraska	18	5	.17	28	.21	2	.01	53	.39	45	.33		
Nevada	3		.30	20	1.06			23	2.25	11	1.08		
New Hampshire				11	.21	2	.04	19	.37	8	.15		
New Jersey	107	114	.51	470	1.08	54	.12	855	1.96	221	.51	4	.01
New Mexico	354	242	.46	1,107	.90	1,743	1.34	3,669	2.82	1,451	1.12	27	.02
New York	98		.08	925	.72	64	.05	1,097	.84	341	.26		
North Carolina	193	846	2.94	728	2.06	61	.17	1,828	5.18	320	.93	29	.08
North Dakota	3	7	.14	10	.14	2	.03	27	.38	29	.41		
Ohio	176	213	.58	626	.93	43	.06	1,058	1.57	328	.49	20	.03
Oklahoma	390	719	4.32	1,416	5.51	231	.90	3,496	13.60	50	.19		
Oregon	27	27	.52	79	.76	7	.07	145	1.40	96	.92		
Pennsylvania [4]													
Rhode Island	6		.09	68	1.00	5	.07	105	1.54	51	.75		
South Carolina	619	549	6.17	789	4.17	57	.30	2,058	10.88	52	.27	6	.03
South Dakota	4	8	.17	19	.27	4	.06	36	.52	15	.22		
Tennessee	179	364	1.86	410	1.40	25	.09	978	3.34	307	1.05	12	.04
Texas	810	405	1.15	764	1.23	112	.18	2,111	3.39	870	1.40	62	1.00
Utah	15	4	.36	46	.88	5	.10	70	1.34	36	.69		
Vermont	7	8	.30	0	.23			24	.62	10	.26		
Virginia	301	208	1.86	609	2.55	56	.20	1,375	5.01	201	.73		
Washington	61	37	.59	127	.76	9	.05	260	1.55	289	1.73		
West Virginia								208	1.09	87	.46		
Wisconsin	20		.10	164	.56	3	.01	196	.67	48	.16		
Wyoming	4	5	.38	16	.68	3	.13	83	1.39	11	.46	1	.04
Puerto Rico [4]													
Virgin Islands [4]													
Total	5,558	6,633	1.13	13,558	1.26	2,891	.27	35,815	3.11	12,136	1.06	308	.05

See footnotes at end of table.

Reports from cities of 200,000 population or over

	Syphilis									Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All syphilis [2]					
	Primary and secondary	Early-latent	Rate per 10,000 population	Includes late latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population
Akron	15	8	.84	16	.58	7	.25	46	1.67	22	.80	1	.04
Atlanta		184	6.13	4	.13			188	6.26	22	.73	1	.03
Baltimore	57	10	.80	112	1.34	1	.01	385	4.61	113	1.35	17	.20
Birmingham	57	26	2.82	121	4.11	13	.44	310	10.53	47	1.60	3	.10
Boston	24	7	.89	92	1.16	6	.08	154	1.94				
Buffalo	19		.32	102	1.70			121	2.01	42	.70		
Chicago	72	157	6.24	749	2.04	40	1.09	1,018	2.78	680	1.86	23	.63
Cincinnati [4]													
Cleveland	31	33	.68	130	1.47	7	.07	210	2.22	85	.90	8	.08
Columbus	14	12	.83	31	.99	5	.16	62	1.98	51	1.63		
Dallas	49	54	3.39	137	4.51	1	.03	241	7.93	113	4.70	15	.49
Dayton	5	3	.36	28	1.26	2	.09	38	1.71	26	1.17		
Denver								134	4.44	80	2.06		
Detroit	54	67	6.06	256	1.41	14	.07	391	2.15	293	1.61	23	1.27
Houston	31	57	2.46	130	3.63	11	.31	321	8.96	107	2.99	4	.11
Indianapolis	14	1	.39	23	.60	2	.05	97	2.52	38	.99		
Jersey City	6	14	.62	20	.62	2	.06	42	1.29	4	.12	2	.06
Kansas City [4]													
Los Angeles		119	.78	348	2.29	20	.14	487	3.20	324	2.13	5	.03
Louisville	19	6	.74	118	3.48	9	.27	180	5.31	67	1.98	3	.09
Memphis [4]													
Milwaukee	7		.11	131	2.08			138	2.19	14	.22	14	.22
Minneapolis	5	6	.22	38	.76	1	.02	50	1.00	68	1.36		
Newark	21	5	.57	178	3.92	6	.13	210	4.62	68	1.50		
New Orleans								81	1.06	45	.92	12	.25
New York	256	242	.66	1,679	2.24	94	.12	2,572	8.43	1,105	1.47	32	.04
Oakland	4	18	.70	86	2.75	2	.06	110	3.51	82	2.62	1	.03
Omaha	6	10	.72	10	.45	1	.04	27	1.21	19	.85		
Philadelphia [4]													
Pittsburgh								349	4.95	14	.20		
Portland [4]													
Providence [4]													
Rochester	3		.09	[7] 31	.90			34	.99	35	1.02		
St. Louis	99	190	3.43	483	5.73	25	.30	797	9.45	137	1.63	4	.05
St. Paul [4]													
San Antonio	134	325	17.55	75	2.87	7	.27	539	20.60	49	1.87	1	.04
San Francisco	61		.89	170	2.47	7	.11	238	3.45	180	2.61	6	.09
Seattle	14	26	1.03	57	1.47	6	.15	157	4.06	147	3.80	1	.03
Syracuse	1	1	.09	84	3.73	6	.27	92	4.08	8	.36		
Toledo	7	2	.29	48	1.54	3	.10	60	1.93	16	.51	3	.10
Washington								542	8.52	229	3.60	2	.03
Total	1,086	1,583	1.03	5,498	2.12	298	.11	10,424	3.71	4,385	1.01	181	.08

[1] Figures preliminary and subject to correction.
[2] Includes "not stated" diagnosis.
[3] Duration of infection under 4 years.
[4] No report for current month.
[5] Breakdown for primary, secondary, and early latent not available.
[6] Includes early latent, late, and late latent.
[7] Includes early latent.

WEEKLY REPORTS FROM CITIES

City reports for week ended April 13, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	142	279	81	7,641	759	2,340	24	406	21	1,242	--------
Current week [1]	51	154	42	2,822	506	2,031	8	340	17	1,025	--------
Maine:											
Portland	0	------	0	150	2	2	0	0	0	5	17
New Hampshire:											
Concord	0	------	0	0	2	0	0	0	0	0	12
Manchester	0	------	0	5	0	0	0	0	0	0	13
Nashua	0	------	0	5	1	0	0	0	0	0	8
Vermont:											
Barre	--------	------	--------	-------	-------	-------	-------	-------	-------	-------	--------
Burlington	0	------	0	0	0	0	0	0	0	0	8
Rutland	0	------	0	0	1	0	0	0	0	0	5
Massachusetts:											
Boston	0	------	0	104	37	74	0	8	0	57	255
Fall River	3	------	0	42	2	1	0	1	0	8	30
Springfield	0	------	0	3	1	6	0	0	0	5	28
Worcester	0	------	0	4	4	12	0	1	0	6	55
Rhode Island:											
Pawtucket	0	------	0	1	0	1	0	0	0	0	19
Providence	2	------	0	103	6	6	0	0	0	6	68
Connecticut:											
Bridgeport	0	2	2	2	3	3	0	1	0	0	44
Hartford	0	------	0	0	2	6	0	0	0	2	61
New Haven	0	3	2	0	3	5	0	1	0	0	42
New York:											
Buffalo	1	------	1	1	8	7	0	4	0	8	128
New York	8	14	3	127	99	717	0	77	4	118	1,550
Rochester	0	------	0	12	2	10	0	2	0	7	77
Syracuse	0	------	0	0	3	13	0	1	0	1	44
New Jersey:											
Camden	0	------	0	0	1	9	0	0	1	0	27
Newark	0	2	0	300	4	28	0	3	1	32	106
Trenton	0	------	0	0	5	5	0	2	0	0	44
Pennsylvania:											
Philadelphia	1	3	1	71	25	116	0	20	1	54	491
Pittsburgh	0	------	2	1	17	28	0	11	1	6	161
Reading	1	------	0	0	0	0	0	1	1	4	16
Scranton	0	------	--------	0	-------	6	0	-------	1	0	--------
Ohio:											
Cincinnati	0	1	1	3	9	4	0	12	0	10	167
Cleveland	0	21	2	0	7	47	0	7	0	20	165
Columbus	0	2	2	1	2	14	0	3	0	14	92
Toledo	0	1	1	1	5	35	0	1	0	18	73
Indiana:											
Anderson	0	------	0	0	2	2	0	0	0	1	12
Fort Wayne	0	------	0	1	0	2	0	3	0	0	26
Indianapolis	0	------	1	1	4	10	0	2	0	8	107
Muncie	0	------	0	0	0	0	0	0	0	0	10
South Bend	0	------	0	0	1	0	0	0	0	1	16
Terre Haute	1	------	2	0	2	1	0	1	0	1	28
Illinois:											
Alton	0	------	0	0	1	0	0	0	0	6	12
Chicago	7	2	3	52	30	526	0	40	0	49	744
Elgin	0	------	0	0	2	1	0	0	0	0	10
Moline	1	------	0	5	0	2	0	0	0	0	10
Springfield	0	------	0	0	3	8	0	0	0	2	16
Michigan:											
Detroit	1	2	0	46	12	61	0	15	1	44	265
Flint	0	------	0	1	8	16	0	2	0	11	35
Grand Rapids	0	------	0	3	7	32	0	0	0	14	42
Wisconsin:											
Kenosha	0	------	0	74	1	4	0	0	0	0	12
Madison	0	------	0	1	1	3	0	0	0	5	17
Milwaukee	0	1	1	22	9	20	0	4	0	8	87
Racine	0	------	0	2	0	5	0	0	0	0	18
Superior	0	------	0	62	0	4	0	0	0	0	6

[1] Figures for Barre estimated; report not received.

City reports for week ended April 13, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Minnesota:											
Duluth	0	------	1	63	1	6	0	0	0	0	28
Minneapolis	2	------	0	3	6	17	1	2	0	7	108
St. Paul	0	------	0	2	1	6	0	0	0	3	46
Iowa:											
Cedar Rapids	0	------	------	33	------	3	0	------	0	1	------
Davenport	0	------	------	17	------	4	0	------	0	0	------
Des Moines	0	------	------	7	------	8	1	------	0	0	43
Sioux City	0	------	------	0	------	1	0	------	0	0	------
Waterloo	0	------	------	2	------	2	0	------	0	0	------
Missouri:											
Kansas City	0	------	0	9	6	12	0	6	0	0	84
St. Joseph	0	------	0	0	2	0	0	1	0	1	31
St. Louis	2	------	0	2	16	21	0	6	0	5	165
North Dakota:											
Fargo	0	------	0	0	0	0	0	0	0	0	7
Grand Forks	0	------	------	0	------	0	0	------	0	1	------
Minot	1	------	0	0	0	0	0	0	0	0	4
South Dakota:											
Aberdeen	0	------	------	0	------	1	0	------	0	2	------
Sioux Falls	0	------	0	0	0	7	0	0	0	0	5
Nebraska:											
Lincoln	0	------	------	1	------	3	0	------	0	0	------
Omaha	0	------	0	15	4	2	0	1	0	3	51
Kansas:											
Lawrence	0	5	0	0	1	0	0	0	0	0	9
Topeka	0	------	0	2	1	2	0	0	0	0	9
Wichita	0	------	0	79	5	2	0	0	0	2	32
Delaware:											
Wilmington	0	------	0	0	3	3	0	0	0	0	27
Maryland:											
Baltimore	1	5	1	1	25	14	0	8	1	103	233
Cumberland	0	------	0	0	0	1	0	0	0	0	13
Frederick	0	------	0	0	1	1	0	0	0	0	5
District of Columbia:											
Washington	2	1	1	3	16	25	0	6	0	10	178
Virginia:											
Lynchburg	0	------	0	2	0	0	0	0	0	11	7
Norfolk	0	17	0	0	4	4	0	0	0	0	27
Richmond	0	------	1	1	2	2	0	6	1	2	54
Roanoke	0	------	0	1	1	4	0	0	0	4	17
West Virginia:											
Charleston	0	2	1	0	5	0	0	0	0	0	28
Huntington	0	------	------	0	------	1	0	------	0	0	------
Wheeling	0	------	------	0	------	0	0	------	0	0	------
North Carolina:											
Gastonia	0	------	------	0	------	1	0	0	------	0	------
Raleigh	0	------	0	0	0	0	0	1	0	2	10
Wilmington	0	------	0	0	0	0	0	1	0	0	8
Winston-Salem	1	1	0	0	3	0	0	1	0	2	26
South Carolina:											
Charleston	1	35	0	0	2	0	0	0	0	0	13
Florence	0	------	0	0	0	0	0	0	0	0	11
Greenville	0	------	0	0	11	0	0	1	0	0	31
Georgia:											
Atlanta	1	9	0	15	0	8	0	5	0	4	95
Brunswick	0	------	0	0	0	0	0	0	1	0	1
Savannah	0	9	1	0	3	0	0	1	0	0	31
Florida:											
Miami	0	2	0	2	3	1	0	1	0	0	44
Tampa	0	2	2	61	0	0	0	1	0	0	21
Kentucky:											
Ashland	0	------	0	0	0	0	0	0	0	2	3
Covington	0	------	0	0	2	0	0	0	1	5	9
Lexington	0	------	0	3	1	2	0	4	0	8	17
Louisville	0	3	0	2	5	24	0	0	0	62	88
Tennessee:											
Knoxville	0	------	0	0	3	8	0	1	0	0	27
Memphis	0	------	2	33	7	16	6	3	0	12	86
Nashville	0	------	1	1	3	0	0	2	0	4	31
Alabama:											
Birmingham	0	3	0	10	5	1	0	3	0	1	61
Mobile	0	4	1	17	0	0	0	2	0	3	23
Montgomery	0	2	------	9	------	0	0	------	0	1	------

City reports for week ended April 13, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	1	-----	0	----	0	0	----	0	0	-------
Little Rock	0	----	0	0	3	0	0	0	0	0	-------
Louisiana:											
Lake Charles	0	---	0	1	0	0	0	0	0	0	3
New Orleans	2	2	1	5	13	6	0	9	0	40	141
Shreveport	0	---	0	0	3	0	0	0	0	0	46
Oklahoma:											
Oklahoma City	0	4	0	0	4	0	0	1	0	2	44
Tulsa	0	----	-------	2	-------	3	0	-----	0	14	-------
Texas:											
Dallas	3	-----	1	119	2	1	0	3	2	26	58
Fort Worth	0	------	2	3	2	4	0	3	1	21	49
Galveston	0	----	0	0	2	1	0	0	0	0	15
Houston	1	1	1	8	3	1	0	6	0	1	81
San Antonio	0	7	2	30	3	1	0	7	0	9	72
Montana:											
Billings	0	------	0	0	1	0	0	0	0	0	12
Great Falls	0	------	0	0	0	0	0	0	0	3	4
Helena	0	------	0	0	0	1	0	0	0	0	2
Missoula	0	------	0	0	2	0	0	0	0	0	7
Idaho:											
Boise	0	------	0	0	0	0	0	0	0	1	10
Colorado:											
Colorado Springs	0	------	0	0	4	2	0	2	0	0	20
Denver	3	------	0	11	2	6	0	6	0	4	78
Pueblo	0	-----	0	3	0	5	0	1	0	0	11
New Mexico:											
Albuquerque	0	------	-------	0	-------	0	0	-------	0	17	-------
Utah:											
Salt Lake City	0	------	0	216	1	5	1	1	0	65	34
Washington:											
Seattle	1	------	0	389	1	2	0	6	1	39	100
Spokane	0	------	0	2	0	3	0	0	1	10	27
Tacoma	0	------	0	3	3	7	0	0	0	1	31
Oregon:											
Portland	2	------	0	210	1	4	0	3	0	9	74
Salem	0	------	-------	4	-------	0	0	-------	0	1	-------
California:											
Los Angeles	3	13	0	16	6	34	0	11	0	28	302
Sacramento	2	1	0	9	5	4	0	2	0	26	33
San Francisco	1	3	2	3	8	12	0	10	0	17	170

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
New York:				District of Columbia:			
New York	3	0	1	Washington	0	1	0
Syracuse	1	0	0	West Virginia:			
Ohio:				Wheeling	1	0	0
Cleveland	1	0	0	Texas:			
Toledo	0	0	1	Dallas	1	0	0
Indiana:				Fort Worth	0	0	1
South Bend	0	1	0	California:			
Illinois:				Los Angeles	0	0	1
Chicago	1	0	0				
Maryland:							
Baltimore	1	0	0				

Encephalitis, epidemic or lethargic.—Cases: New York, 3; Rochester, 1; Pittsburgh, 1; Columbus, 1; Great Falls, 1.

Pellagra.—Cases: Savannah, 2; Memphis, 2; Birmingham, 1; Dallas, 1; San Francisco, 3.

Typhus fever.—Cases: New York, 1; Miami, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended March 30, 1940.—During the week ended March 30, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			1	4	3				1	9
Chickenpox		14		184	374	30	5	15	53	675
Diphtheria			2	16	2	2	1	1		24
Dysentery				90	1					91
Influenza		15			55		10		2	82
Measles			1	136	618	621	141	5	67	1,502
Mumps				32	254	9	126	3	7	431
Pneumonia	7	4			24	6	2		5	48
Poliomyelitis						1	1			2
Scarlet fever		6	5	88	126	9	3	23	4	264
Trachoma						1			3	4
Tuberculosis		36	15	54	56			1		162
Typhoid and paratyphoid fever				26	2	36			1	65
Whooping cough	2		4	97	97	18	20	4	21	263

FINLAND

Communicable diseases—4 weeks ended February 24, 1940.—During the 4 weeks ended February 24, 1940, cases of certain communicable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	251	Poliomyelitis	6
Dysentery	2	Scarlet fever	475
Influenza	2,546	Typhoid fever	25
Paratyphoid fever	29	Undulant fever	1

JAMAICA

Communicable diseases—4 weeks ended January 20, 1940.—During the 4 weeks ended January 20, 1940, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	--------	11	Puerperal sepsis	--------	2
Diphtheria	--------	2	Tuberculosis	29	73
Dysentery	12	3	Typhoid fever	6	42
Leprosy	--------	3			

SCOTLAND

Vital statistics—Fourth quarter 1939.—Following are vital statistics for Scotland for the fourth quarter of 1939:

	Number	Rate per 1,000 population		Number	Rate per 1,000 population
Marriages	13,015	10.3	Deaths from—Continued.		
Births	20,306	16.1	Homicide	6	--------
Deaths	16,159	12.8	Influenza	87	.07
Deaths under 1 year	1,403	[1] 69	Lethargic encephalitis	14	--------
Deaths from:			Measles	5	--------
Appendicitis	100	--------	Nephritis, acute and chronic	331	--------
Cancer	2,005	1.59	Pneumonia (all forms)	640	.51
Cerebral hemorrhage and apoplexy	1,130	--------	Poliomyelitis	3	--------
Cerebrospinal fever	18	.01	Puerperal sepsis	14	--------
Cirrhosis of the liver	47	--------	Scarlet fever	8	.01
Diabetes mellitus	211	--------	Senility	631	--------
Diarrhea and enteritis (under 2 years)	237	--------	Suicide	90	--------
Diphtheria	129	.10	Syphilis	19	--------
Dysentery	13	--------	Tetanus	2	--------
Erysipelas	12	--------	Tuberculosis (all forms)	806	.64
Heart disease	4,094	--------	Typhoid fever and paratyphoid fever	5	--------
			Whooping cough	32	.03

[1] Per 1,000 live births.

Vital statistics—Year 1939.—Following are vital statistics for Scotland for the year 1939:

	Number	Rate per 1,000 population		Number	Rate per 1,000 population
Marriages	46,257	9.2	Deaths from—Continued.		
Live births	86,899	17.4	Heart disease	15,458	--------
Deaths	64,413	12.9	Influenza	915	--------
Deaths under 1 year	5,955	[1] 69	Measles	15	--------
Deaths from:			Nephritis, acute and chronic	1,756	--------
Appendicitis	387	--------	Pneumonia (all forms)	2,919	.59
Cancer	8,040	1.61	Puerperal sepsis	88	--------
Cerebral hemorrhage and apoplexy	6,760	--------	Scarlet fever	47	--------
Cirrhosis of the liver	170	--------	Suicide	458	--------
Diabetes mellitus	819	--------	Tuberculosis (all forms)	3,526	.70
Diarrhea and enteritis (under 2 years)	1,041	--------	Typhoid fever and paratyphoid fever	26	--------
Diphtheria	305	--------	Whooping cough	307	--------

[1] Per 1,000 live births.

VIRGIN ISLANDS

Notifiable diseases—January–March 1940.—During the months of January, February, and March 1940, cases of certain notifiable diseases were reported in the Virgin Islands as follows:

Disease	January	February	March	Disease	January	February	March
Cerebrospinal meningitis	--------	1	--------	Pneumonia	------	1	--------
Chickenpox	--------	1	1	Schistosomiasis	---	1	--------
Filariasis	11	5	10	Syphilis	17	19	18
Gonorrhea	19	10	13	Tetanus	1	----	1
Hookworm disease	4	6	3	Trachoma	-----	3	--------
Malaria	2	1	--------	Tuberculosis	1	1	1
Pellagra	--------	1	--------	Typhoid fever	--------	1	--------

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of April 26, 1940, pages 715–719. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Argentina—Salta Province—Isla (vicinity of).—For the period March 16–31, 1940, 1 case of plague with 1 death was reported in the vicinity of Isla, Salta Province, Argentina.

Hawaii Territory—Island of Hawaii—Hamakua District—Hamakua Mill Area.—A rat found on March 25, 1940, in Hamakua Mill Area, Hamakua District, Island of Hawaii, T. H., has been proved positive for plague.

Smallpox

Thailand—Bangkok.—During the week ended April 6, 1940, 2 cases of smallpox were reported in Bangkok, Thailand.

Yellow Fever

Colombia—Caldas Department—Samana.—On March 23, 1940, 1 death from yellow fever was reported in Samana, Caldas Department, Colombia.

Gold Coast—Prestea (vicinity of).—On April 6, 1940, 1 fatal case of yellow fever was reported in the vicinity of Prestea, Gold Coast.

Nigeria—Ogoja Region—Enugu.—On April 1, 1940, 1 suspected case of yellow fever was reported in Enugu, Ogoja Region, Nigeria.

Public Health Reports

VOLUME 55 MAY 10, 1940 NUMBER 19

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work. Articles of special interest are issued as reprints or as supplements, in which forms they are made available for more economical and general distribution.

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Public Health Reports

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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

March 24–April 20, 1940

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the Public Health Reports under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended April 20, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935–39.

As during the preceding 4-week period, the incidence during the 4 weeks ended April 20 of all of the eight communicable diseases under consideration was again below the median expectancy for the period.

Diphtheria.—The diphtheria incidence continued at a comparatively low level, 1,055 cases, as compared with 1,322 for the corresponding period in 1939, and a median figure of 1,724 for the years 1935–39. In the Mountain region the number of cases stood at about the average seasonal level, but in all other regions the incidence was relatively low.

Influenza. The number of reported cases of influenza (approximately 13,000) was about 35 percent of the number reported for the corresponding period in 1939 and slightly less than 10 percent of the 1935 39 median figure for this period. In the South Atlantic, West South Central, and Mountain regions, where the disease has been most prevalent during the recent rise, the incidence still continued considerably above the normal expectancy. The incidence was very satisfactory in all other sections of the country, a significantly low incidence being reported in the East South Central and Pacific regions.

Measles.—The incidence of measles continued at a relatively low level. During the 4 weeks ended April 20 the reported cases totaled 38,323, as compared with approximately 59,000 cases for the corresponding period in 1939, which figure also represents the 1935–39 median incidence for this period. The West South Central and

Pacific regions reported a higher incidence than might normally be expected, but in all other regions the incidence was considerably below the average incidence for recent years.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period Mar. 24–Apr. 20, 1940, the number for the corresponding period in 1939, and the median number of cases for the corresponding period 1935–39 [1]

Division	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median
	Diphtheria			Influenza [2]			Measles			Meningococcus meningitis		
United States [1]	1,055	1,322	1,724	12,584	34,334	14,019	38,323	59,102	39,102	157	176	659
New England	24	24	45	30	340	64	5,463	7,754	7,751	4	8	15
Middle Atlantic	175	229	370	92	147	125	5,670	7,321	18,818	15	48	104
East North Central	142	292	320	1,074	2,212	1,176	4,069	4,456	4,753	16	28	77
West North Central	83	122	171	169	1,142	577	4,354	5,220	5,220	8	9	28
South Atlantic	235	225	278	4,240	11,120	3,710	2,469	9,332	7,725	27	27	108
East South Central	86	103	111	1,262	6,809	2,400	1,280	1,021	1,484	24	24	62
West South Central	152	168	268	4,543	9,278	4,360	3,936	3,459	3,305	22	14	41
Mountain	66	82	64	663	2,045	436	3,291	3,930	3,777	2	6	11
Pacific	92	77	119	511	1,232	1,232	7,791	16,909	7,272	9	12	23
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States [1]	64	80	77	20,480	18,008	29,478	277	1,267	1,207	339	434	457
New England	0	0	1	1,304	1,315	1,820	0	0	0	11	21	20
Middle Atlantic	4	11	8	7,377	4,574	8,162	0	4	0	61	64	59
East North Central	9	15	10	7,429	7,335	9,638	37	355	321	50	38	61
West North Central	5	3	5	1,158	1,736	2,823	129	451	558	24	19	19
South Atlantic	10	27	9	846	718	946	6	6	6	13	83	83
East South Central	6	7	7	813	562	415	18	46	20	48	42	56
West South Central	11	8	9	281	336	619	33	230	146	51	120	117
Mountain	7	4	4	494	426	677	30	55	91	25	14	15
Pacific	12	5	15	778	1,006	1,139	15	114	111	23	30	30

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 44 States and New York City.
[3] 47 States. Mississippi is not included.

Meningococcus meningitis.—The recorded incidence of meningococcus meningitis (157 cases) was about 90 percent of that for the corresponding period of 1939 and less than 25 percent of the median figure (690) for this period. In all regions the numbers of cases reported were low in relation to the seasonal expectancy. For the country as a whole the current incidence is the lowest on record for this period.

Poliomyelitis.—For the 4 weeks ended April 20 there were 64 cases of poliomyelitis reported, as compared with 80, 71, and 96 for the corresponding period in 1939, 1938, and 1937, respectively. The situation was favorable in all sections of the country. In 7 of the 12 years for which these data are available the lowest incidence for the year has been reached during the 4-week period corresponding to the current one, while during 5 of the years the incidence reached its lowest level during the preceding 4-week period and rather sharp

rises occurred during the period corresponding to the one under consideration.

Scarlet fever.—The number of cases of scarlet fever (20,480) was about 10 percent above the number reported for the corresponding period in 1939, but it was only about 70 percent of the average seasonal incidence of recent years. In the East South Central region the number of cases was more than twice the median figure for this period; of the total cases (813), Kentucky reported 362 and Tennessee 364. The numbers of cases reported in all other regions were low in relation to the preceding 5-year median figure.

Smallpox.– For the country as a whole the current incidence of smallpox is the lowest on record for this period. For the 4 weeks ended April 20 there were 277 cases reported, as compared with 1,267, 1,882, and 1,443 cases for the corresponding period in 1939, 1938, and 1937, respectively.

Typhoid fever. Typhoid fever also continued at the lowest level on record in relation to the seasonal expectancy. There were 339 cases reported for the current period, approximately 75 percent of last year's figure for this period, and also of the median figure (457 cases). In all regions except the Middle Atlantic, West North Central, and Mountain, reported cases were low in relation to the preceding 5-year median.

MORTALITY, ALL CAUSES

The average death rate for large cities for the 4 weeks ended April 20, based on data received from the Bureau of the Census, was 12.0 per 1,000 inhabitants (annual basis), as compared with 12.2 for the corresponding period in 1939, and an average rate of 12.4 for the 5 preceding years.

TREND OF MORBIDITY AND MORTALITY DURING 1939 AND RECENT PRECEDING YEARS

MORBIDITY

The following data concerning the prevalence of eight communicable diseases are based on reports submitted by the health officers of the several States and the District of Columbia. Although cases of each of these diseases are reportable by law, there is considerable variability in the completeness of the reports. The number of cases reported is somewhat smaller than the number of cases which occur during any given year, but it is believed that the reports are sufficiently accurate to reveal any unusual prevalence arising from an epidemic.

DISEASES ABOVE THE MEDIAN PREVALENCE

The number of reported cases of influenza was more than twice as large as that reported in 1938 and about 40 percent above the median number for the period 1934–1938 (table 1). The number of reported cases of smallpox was one-third less than in 1938 but more than 20 percent greater than the previous 5-year median.

The outbreak of influenza started later in the winter than usual; an increased number of cases was first reported about the middle of February, after which the epidemic spread rapidly until it reached its peak about a month later. The decline from this peak was slower than usual so that an excess of cases was reported until June. Another minor outbreak of influenza started during the latter part of November.

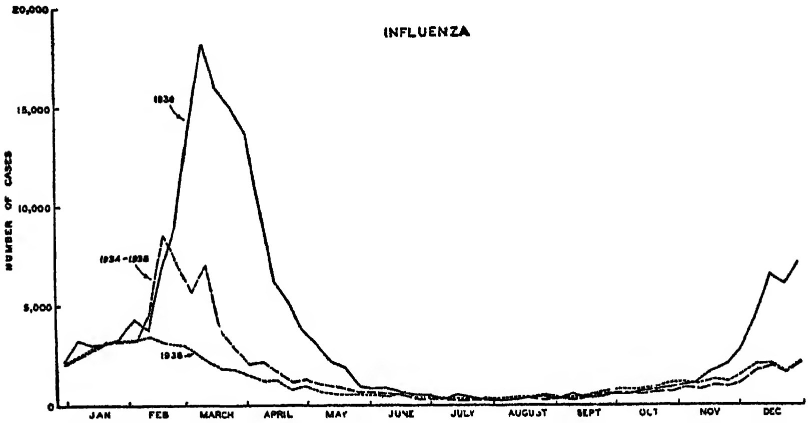

FIGURE 1.—Number of reported cases of influenza by weeks for 1939, 1938, and the median number for 1934–38.

This outbreak was confined principally to the South and to the Mountain States; it rose slowly to a peak around February 1, 1940, and has since subsided.

TABLE 1.—*Number of reported cases of certain communicable diseases in the United States in 1938 and 1939 and the median number of cases reported, 1934–38*

Disease	1939		1938		Median 1934–38	
	Cases	Number of States reporting	Cases	Number of States reporting	Cases	Number of States reporting
Diphtheria	23,894	48	30,508	48	30,508	48
Influenza [1]	272,560	42	129,834	42	196,917	42
Measles	402,673	48	822,811	48	743,856	48
Meningococcus meningitis [2]	1,884	44	2,909	44	5,184	44
Poliomyelitis	7,324	48	1,705	48	7,517	48
Scarlet fever	162,750	48	180,631	48	228,887	48
Smallpox	9,765	48	14,939	48	7,957	48
Typhoid and paratyphoid fever	12,967	48	14,903	48	16,033	48

[1] New Hampshire, Massachusetts, New York, Pennsylvania, Michigan, and Colorado are omitted.
[2] New Hampshire, Vermont, South Carolina, and Nevada are omitted.

Figures for 1939 are preliminary.

The smallpox incidence during 1939 was a continuation of the high prevalence which prevailed throughout 1938. The number of cases has been slowly increasing since 1930, when slightly more than 5,000 cases were reported. This trend apparently reached its highest point during 1938, for since that time the number of cases, although still above the median, has been slowly declining.

DISEASES BELOW THE MEDIAN PREVALENCE

The numbers of cases of diphtheria, measles, meningococcus meningitis, poliomyelitis, scarlet fever, and typhoid and paratyphoid fever reported in 1939 were well below the median numbers reported during the previous 5 years, 1934–1938. Moreover, each of these dis-

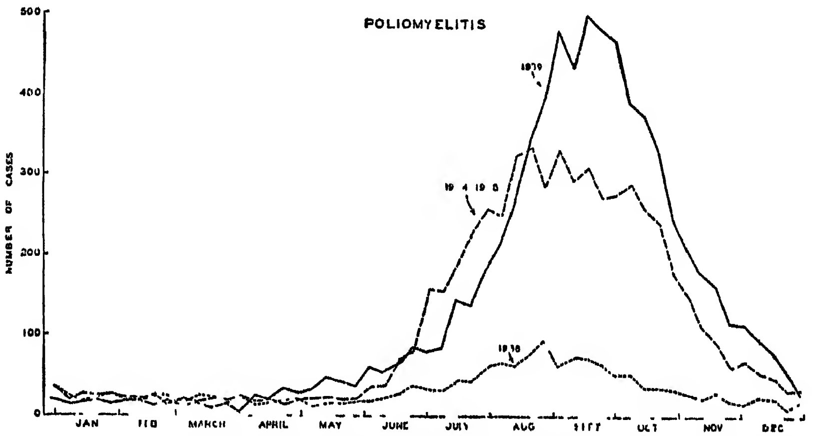

FIGURE 2. Number of reported cases of poliomyelitis by weeks for 1939, 1938, and the median number for 1934–38.

eases except poliomyelitis was less prevalent than in 1938. Although the number of cases of poliomyelitis was below the median it was about four times greater than that reported during 1938. The outbreak started early in the summer in the South Atlantic States and later spread to all sections of the country.

MORTALITY

(Based on Provisional Data for All Years)

The mortality rates in this report are based on preliminary data for 45 States, the District of Columbia, Hawaii, and Alaska for the calendar year 1939. Data are presented for each State except Arizona, Arkansas, and New Hampshire. In addition, mortality rates by quarters are presented for 1937, 1938, and 1939 for 43 States and the District of Columbia (all except Arizona, Arkansas, Mississippi, New Hampshire, and Texas).

This report is made possible through a cooperative arrangement with the respective States which voluntarily furnish provisional

tabulations of current birth and death records to the United States Public Health Service which provides for the publication of the data received. Because of (a) lack of uniformity in the method of classifying deaths according to cause, (b) insufficient time to obtain additional information to aid in the classification of doubtful cases, and (c) the impossibility of including a certain number of certificates that had not been filed when the records were tabulated, these data are preliminary and may differ in some instances from the final figures subsequently published by the Bureau of the Census.

Preliminary data for preceding years from the same source, collected and tabulated in the same way as the current data, are included for comparative purposes. These figures are used in preference to the final figures published by the Bureau of the Census because it is believed that they are more comparable with current provisional information.

In the past these preliminary reports have provided an early and accurate index of the trend in mortality for the country as a whole. Some deviation from the final figures for individual States may be expected because of the provisional nature of the reports. It is believed, however, that the trend of mortality within each State is correctly represented. Comparisons of specific causes of death among the States are subject to some error because of differences in tabulation procedure and completeness of reporting. Comparisons of this nature should be made only from the final figures published by the Bureau of the Census.

Preliminary tabulations indicate that 1939 will rank with 1938 as a year with the lowest mortality rate on record. As shown by the data for 45 States and the District of Columbia in table 1 the provisional rate for 1939, 10.5 per 1,000 population, is identical with the corresponding rate for 1938. The data in table 2, based upon reports from 43 States and the District of Columbia, show a slightly higher rate for 1939 than for 1938. It seems safe to conclude that the two rates will differ only slightly, if at all.

The record for 1939 would have been even more favorable than that for 1938 if there had not been a mild outbreak of influenza which resulted in a higher death rate during the first quarter of the year (fig. 3). The death rate from May to December was lower in 1939 than in 1938. This favorable condition with respect to mortality was fairly widespread, only 19 of the 46 States reporting a higher rate in 1939 than in 1938.

DISEASES WITH LOWER DEATH RATES

The mortality rate from the following diseases was the lowest reported during the past 5 years: Typhoid and paratyphoid fever, measles, scarlet fever, diphtheria, encephalitis, meningitis, tuberculosis, malaria, pellagra, pneumonia, digestive diseases, diarrhea and

enteritis (under 2 years), nephritis, and accidents, including automobile accidents. In addition, the death rate from whooping cough was lower than in 1938 although it was slightly higher than the rate for 1936.

The maternal mortality rate declined for the tenth consecutive year. The provisional rate is 10 percent less than in 1938 and more than 40 percent less than in 1930. The rate is below 4 per 1,000 live births for the first time since such data have been available.

The death rate from pneumonia was especially low and represents a decline of more than one-third since 1936. It is quite possible that the marked decrease in the past 2 years in the mortality from pneu-

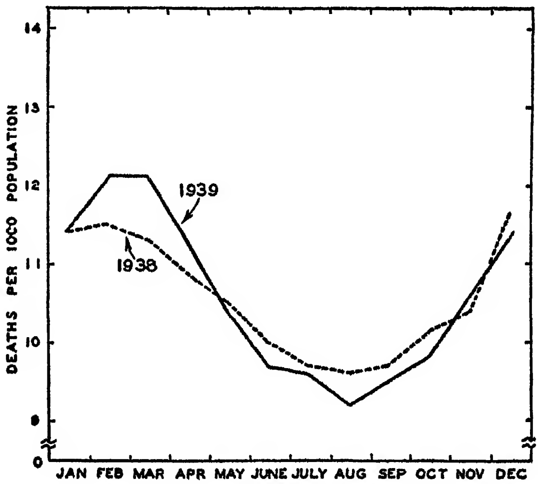

FIGURE 3.—Number of deaths per 1,000 estimated population for 41 States and the District of Columbia, by months for 1938 and 1939 (does not include data for Arizona, Arkansas, New Hampshire, and Texas)

monia reflects an increasing use of recently discovered methods of treatment. Only 2 States reported a higher death rate than in 1938.

The widespread safety campaign against automobile accidents has resulted in a decreased death rate for the second consecutive year. The provisional rate for 1939, 23.7 per 100,000 population, is 20 percent less than the corresponding rate for 1937. One-half of the States reported a lower rate than in 1938 and the other half reported a higher rate.

The four principal communicable diseases of childhood, measles, whooping cough, scarlet fever, and diphtheria, were each less prevalent than in the preceding year. For diphtheria, the death rate has declined nearly 50 percent during the past 5 years.

DISEASES WITH INCREASED DEATH RATES

The principal diseases for which a higher mortality rate was reported in 1939 than in 1938 are influenza, cancer, diabetes, cerebral hemorrhage, and heart disease. In addition there was a minor

epidemic of poliomyelitis which increased the rate slightly over that reported in 1938.

The epidemic of influenza in the late winter of 1939 has already been mentioned. The increase in mortality occurred in all parts of the country, 42 of the 46 States reporting a higher rate in 1939 than in 1938.

The remaining diseases with a higher death rate in 1939, cancer, diabetes, cerebral hemorrhage, and heart disease, are primarily disorders of late adult life and old age, and part of the increase in deaths from these causes results from the aging of the population. With the exception of diabetes, the rates for these causes increased less than 4 percent.

BIRTH RATE AND INFANT MORTALITY

The infant mortality rate, 47 per 1,000 live births, is the lowest on record and represents a decline of 15 percent during the past 5 years. Only 5 States reported a higher rate in 1939 than in 1938.

After a temporary rise in 1937 and 1938, the birth rate decreased about 2 percent during 1939. A decrease was reported by 28 of the 46 States. The crude rate of natural increase, 6.6 per 1,000 population, was slightly less than that for 1938, 7.0 per 1,000 population.

TABLE 1.—*Summary of mortality trends from certain causes in a group of 46 States, 1935–39* [1] *(estimated population July 1, 1939, 128,153,000)* [2]

RATES PROVISIONAL FOR ALL YEARS

Diseases (numbers in parentheses are from the International List of Causes of Death, fourth revision, 1929)	1939	1938	1937	1936	1935
	Rate per 1,000 population				
Deaths, all causes	10.5	10.5	11.1	11.4	10.9
Births, exclusive of stillbirths	17.1	17.5	16.9	16.5	16.8
	Rate per 1,000 live births				
Infant mortality (live births, 1939, 2,186,462)	47	50	54	57	55
Maternal mortality	3.8	4.2	4.7	5.5	5.7
	Death rate per 100,000 population				
Typhoid and paratyphoid fever (1, 2)	1.5	1.7	2.0	2.4	2.6
Measles (7)	.9	2.4	1.0	.9	3.0
Scarlet fever (8)	.6	.9	1.4	1.0	2.1
Whooping cough (9)	2.2	3.5	3.7	2.0	3.7
Diphtheria (10)	1.5	1.9	2.0	2.3	2.9
Influenza (11)	16.1	12.3	29.1	25.4	22.0
Poliomyelitis and polioencephalitis (16)	.6	.4	1.0	.6	.8
Encephalitis, epidemic or lethargic (17)	.4	.6	.7	.6	.6
Epidemic cerebrospinal meningitis (18)	.5	.8	1.6	2.2	2.1
Tuberculosis, all forms (23-32)	45.5	47.8	52.2	54.4	54.1
Malaria (38)	1.1	1.5	1.8	2.8	3.1
Cancer, all forms (45-53)	115.5	113.9	110.4	110.5	107.8
Diabetes (59)	25.0	23.4	23.8	23.5	22.1
Pellagra (62)	1.7	2.3	2.4	2.8	2.7
Cerebral hemorrhage, apoplexy (82a, b)	85.9	83.0	84.3	88.0	83.6
Diseases of the heart (90-95)	277.1	267.6	261.3	261.9	241.4
Pneumonia, all forms (107-109)	58.2	66.4	84.4	91.6	82.0
Diseases of the digestive system (115-129)	59.3	62.5	65.2	69.5	68.0
Diarrhea and enteritis under 2 years (119)	8.1	10.3	10.6	11.4	10.0
Nephritis, all forms (130-132)	73.3	76.0	78.4	82.5	80.8
All accidents (176-195, 201-214)	70.1	71.0	80.2	85.3	78.7
Automobile accidents (206, 208, 210)	23.7	24.1	29.4	29.3	28.4

[1] The States included are those listed in table 3. The District of Columbia is counted as a State.

[2] Populations used for the years 1935 to 1937, inclusive, are the official estimates as of July 1 of each year made by the Bureau of the Census. Estimates for 1938 and 1939 are made by assuming the same actual increment between 1937 and 1938, and 1938 and 1939 as between 1936 and 1937 as given in the official estimates for those years. No official estimates for States are available for 1938 and 1939.

TABLE 2.—*Trends of mortality from certain causes in each quarter of 1939, 1938, and 1937 in the 44*[1] *States with available data (estimated population July 1, 1939, 119,832,000)*

RATES PROVISIONAL FOR ALL YEARS

State and period	All causes, rate per 1,000 population (annual basis)	Births (exclusive of stillbirths) per 1,000 population (annual basis)	Rate per 1,000 live births		Death rate per 100,000 population (annual basis)																			
			Total infant mortality	Maternal mortality	Typhoid and paratyphoid fever (1, 2)	Measles (7)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Influenza (11)	Acute poliomyelitis and polioencephalitis (16)	Encephalitis, epidemic or lethargic (17)	Epidemic cerebrospinal meningitis (18)	Tuberculosis, all forms (23–32)	Cancer, all forms (45–53)	Diabetes (59)	Cerebral hemorrhage, apoplexy (82a, b)	Diseases of the heart (90–95)	Pneumonia, all forms (107–109)	Diseases of the digestive system (115–129)	Diarrhea and enteritis (under 2 years (119))	Nephritis (130–132)	All accidents (176–194, 201–214)	Automobile accidents (206, 208, 210)
January–December:																								
1939	10.6	16.9	46	3.7	1.3	0.8	0.7	2.0	1.4	15.4	0.5	0.5	0.5	44.9	113.8	25.8	87.3	284.7	58.4	59.0	7.0	73.9	70.7	23.8
1938	10.5	17.2	49	4.1	1.5	2.4	1.0	3.3	1.8	11.3	.3	.6	.8	46.6	116.7	24.2	84.5	270.8	63 2	62.3	9.3	76.5	71.0	24 0
1937	11.1	16.7	52	4.6	1.7	.8	1.4	3.6	1.8	27.4	1.0	.7	1.6	51.1	113.2	24.1	85.6	268.1	84.1	64.5	9.3	78.9	79.9	29.2
January–March:																								
1939	11.9	16.3	54	4.1	.8	1.4	1.2	2.4	1.6	32.1	.2	.5	.7	46.9	119.1	29.7	96.5	323.5	104.1	55.7	4.1	84.6	64 1	19.4
1938	11.4	16.6	52	4.4	.8	4.0	1.6	3.4	1.9	21.6	.3	.6	1.2	48.7	115.3	26.5	90.3	292.9	103.4	55.9	4.2	83.0	64.8	20.8
1937	12.9	15.6	64	5.6	.9	.8	2.5	3.3	2.1	74.1	.3	.7	2.7	55.9	112.0	28.7	95.3	309.0	149.4	59.8	4.5	87.8	73.3	25.6
April–June:																								
1939	10.4	16.4	45	4.0	.8	1.3	.7	2.3	.8	16.4	.3	.4	.5	48.0	117.9	25.5	86.2	281.0	51.8	57.9	5.9	75.1	67.0	20.2
1938	10.5	16.8	50	4.3	1.1	4.4	1.0	4.1	1.0	8.6	.3	.6	.8	49.8	116.4	23.8	83.8	268.2	60.0	64.7	10.0	78.6	65 1	20 3
1937	10.9	16.3	51	4.8	1.1	1.3	1.7	3.3	1.1	19.4	.3	.6	1.9	54.2	112.3	23.0	84.1	263.2	75.8	64.1	7.7	81.2	76.1	25.8
July–September:																								
1939	9.4	17.7	41	3.5	2.3	.3	.3	1.9	.9	3.3	1.0	.5	.4	42.2	117.3	22.1	77.1	242.8	27.2	65.6	11.2	64.5	74.0	24.8
1938	9.6	18.0	46	4.0	2.5	.8	.4	3.4	1.2	3.9	4.3	.7	.5	44.7	116.1	21.4	76.1	237.6	33.6	70 2	15.4	68.7	76.9	25.3
1937	9.8	17.6	47	4.2	3.2	.5	.5	4.7	1.2	4.3	2.3	.6	.8	47.9	113.1	20.7	75.1	227.8	35.3	73.9	16.8	69.1	86.4	31.0
October–December:																								
1939	10.6	17.1	45	3.4	1.2	.2	.6	1.6	2.4	10.2	.7	.4	.4	42.7	120.9	26.1	89.7	292 5	51.5	56.8	6.8	71.7	77.3	30 7
1938	10.7	17.3	49	3.7	1.5	.4	.8	2.4	2.9	11.1	.3	.5	.6	43.4	119.1	25.2	88.0	285.0	68.5	58 3	7.6	76.0	73.7	29.3
1937	10.9	17.2	49	3.9	1.8	.6	1.1	3.0	2.9	12.5	.9	.9	1.0	46.7	115.2	24.0	88.2	273.0	77.4	59.9	8.2	77.7	83.7	34.5
Metropolitan Life Insurance Co., industrial policyholders (January–December):[2]																								
1939	7.6	------	------	------	.7	.6	.7	1.6	1.3	9.8	------	------	------	44.9	101.1	27.5	59.7	[3] 160.5	42.9	------	3.7	[4] 51.4	46.3	17.1
1938	7.7	------	------	------	1.0	1.6	1.1	2.0	1.7	7.5	------	------	------	47.2	95.8	24.8	58.5	[3] 154.0	50 6	------	5.3	[4] 53.8	48.4	17.6
1937	8.2	------	------	------	.9	1.0	1.6	3.0	1.9	18.2	------	------	------	52.1	96.0	25.6	59.7	[3] 159.7	66 9	------	6.6	[4] 55 7	53.9	21.0

[1] States included are those listed in table 3 with the exception of Mississippi and Texas. The District of Columbia is counted as a State.

[2] These data are taken from the Monthly Statistical Bulletin published by the Metropolitan Life Insurance Co. The figures are subject to correction, since they are based on provisional estimates of lives exposed to risk. Data does not include all diseases reported to the Public Health Service.

[3] Excludes pericarditis, acute endocarditis, acute myocarditis, coronary artery diseases, and angina pectoris.

[4] Chronic nephritis (Bright's disease) only.

Table 3.—*Trend of death rates from all causes, of birth rates, and of infant and maternal mortality rates, 1935–39*

RATES PROVISIONAL FOR ALL YEARS

State	Deaths, all causes (rate per 1,000 population)					Births, exclusive of stillbirths (rate per 1,000 population)					Infant mortality (rate per 1,000 live births)					Maternal mortality (rate per 1,000 live births)				
	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935
Alabama	9.8	10.3	10.7	10.9	10.1	21.3	21.6	21.4	21.3	22.0	60	61	63	66	63	5.8	6.2	5.9	6.7	6.2
Alaska [1]	18.3	20.0	19.3			23.5	29.1	22.1			121	(2)	131			3.3	1.6	11.3		
California	12.2	12.2	13.0	12.5	12.1	16.4	15.5	15.3	13.9	13.3	42	46	54	53	50	3.0	3.5	4.2	4.7	4.7
Colorado	11.6	11.7	13.0	12.8	12.4	19.0	18.9	18.8	17.1	17.7	53	59	70	74	73	5.1	4.3	5.5	7.1	7.3
Connecticut	9.8	10.0	10.1	10.1	10.1	12.2	13.4	12.8	12.4	12.4	38	36	41	42	43	2.9	2.7	2.9	4.5	4.3
Delaware	11.9	12.0	13.8	12.8	12.5	16.3	16.7	16.4	15.1	15.8	44	51	66	64	66	4.7	5.7	4.4	7.1	6.4
District of Columbia	12.9	12.5	13.9	14.7	14.3	21.7	20.3	19.5	19.0	18.3	47	48	61	72	59	4.7	5.4	5.3	6.9	6.7
Florida	12.3	12.3	12.6	12.8	12.4	18.4	17.9	17.7	17.1	17.4	57	58	60	59	62	6.4	7.3	6.8	8.1	8.7
Georgia	9.7	10.5	10.8	11.9	11.0	19.8	20.1	19.9	19.4	19.9	59	63	62	70	69	5.5	6.6	7.4	7.9	7.2
Hawaii	6.7	7.0	7.9	7.8	7.8	19.3	19.7	20.0	19.7	21.7	54	59	69	73	67	3.5	3.8	4.7	4.5	4.3
Idaho	9.5	9.1	9.7	10.8	10.1	22.4	22.7	21.6	21.4	20.4	45	45	45	50	51	2.5	3.7	3.9	3.2	6.2
Illinois	11.0	10.7	11.1	11.8	10.9	14.9	15.4	14.6	14.3	14.3	38	41	43	47	46	3.0	3.3	3.8	4.2	4.7
Indiana	10.8	10.6	11.2	11.7	11.0	15.2	15.8	14.5	14.2	14.0	41	45	53	53	54	3.9	3.8	3.7	4.7	5.2
Iowa	9.7	9.4	9.7	9.9	10.3	16.8	16.9	16.5	16.7	15.8	38	38	44	42	47	2.5	3.1	4.0	4.1	5.4
Kansas	9.9	10.0	10.3	11.5	10.8	15.4	16.0	15.6	16.2	16.8	39	43	45	51	49	3.4	4.0	4.1	5.1	5.3
Kentucky	9.8	9.3	10.2	11.2	10.3	19.7	23.3	21.0	19.3	20.3	54	49	50	67	59	4.4	3.8	3.8	5.6	5.3
Louisiana	11.4	11.5	11.7	12.2	11.2	22.4	22.3	20.9	19.5	19.4	61	66	64	73	68	6.0	6.0	7.5	8.7	7.9
Maine	12.5	12.0	13.2	13.3	13.0	17.3	17.8	18.1	17.9	18.6	51	49	61	64	63	4.2	4.2	5.4	5.1	5.7
Maryland	12.3	12.4	13.2	13.1	12.7	16.7	17.4	16.4	16.0	16.4	50	55	62	68	62	3.3	3.4	4.1	4.3	5.0
Massachusetts	10.6	11.0	11.3	11.8	11.5	(2)	13.8	13.9	13.9	14.4	(2)	40	44	47	48	(2)	3.9	4.6	4.9	5.7
Michigan	10.6	10.4	11.1	11.4	10.8	19.3	19.9	19.0	18.5	18.5	42	45	48	50	47	2.9	3.5	3.6	4.7	4.9
Minnesota	9.9	9.7	10.0	10.7	9.9	18.2	17.6	17.6	16.9	16.4	36	40	42	48	46	2.5	2.8	3.1	4.4	4.9
Mississippi	10.5	11.3	11.8	12.0	10.6	(2)	26.5	25.8	24.6	24.1	(2)	57	59	58	54	(2)	5.9	7.1	6.9	6.7
Missouri	10.7	10.6	11.4	12.3	11.0	16.1	15.7	14.3	14.1	14.6	43	48	58	58	57	3.4	3.6	5.2	6.1	5.7
Montana	10.7	10.4	11.2	11.7	11.8	19.7	19.6	19.0	19.5	19.0	50	43	49	53	55	3.2	3.7	3.4	5.5	4.6
Nebraska	8.8	8.7	9.6	10.0	9.7	15.9	16.0	15.9	17.0	16.6	34	36	42	44	42	3.4	3.4	3.9	5.6	5.7
Nevada	11.9	12.3	12.6	14.4	13.3	18.3	18.0	15.8	14.2	14.4	44	45	49	70	71	4.2	3.0	0.9	5.6	7.7
New Jersey	10.0	10.0	10.1	10.3	10.1	12.9	13.0	12.6	12.3	12.7	38	39	39	44	47	2.9	3.5	3.4	3.8	4.5
New Mexico	13.4	13.4	13.2	14.8	14.9	36.8	35.2	32.8	30.6	21.3	96	109	124	122	129	4.3	4.6	5.0	7.4	6.9
New York	11.3	11.2	11.9	11.6	11.5	14.2	14.5	14.3	13.9	14.2	39	40	45	47	48	3.0	3.8	3.9	4.9	5.1
North Carolina	9.0	9.6	9.8	10.4	9.9	22.6	22.9	23.1	22.2	23.3	58	68	65	67	67	4.8	5.6	5.4	6.5	6.6
North Dakota	7.7	7.3	7.9	8.0	8.4	13.9	18.5	18.4	19.3	19.5	48	48	53	50	59	2.3	2.2	4.8	4.3	5.3
Ohio	11.4	11.0	11.8	12.1	11.5	15.8	16.7	15.8	15.4	15.1	42	42	50	51	50	3.6	3.8	4.6	4.9	6.2
Oklahoma	8.1	7.8	8.5	9.2	8.4	17.0	17.5	16.2	16.5	17.4	52	43	59	60	55	4.2	4.0	6.9	6.2	5.9
Oregon	11.2	11.3	12.0	12.2	11.3	15.0	15.7	15.1	13.7	13.1	35	38	42	44	41	2.4	3.1	3.5	5.1	5.4
Pennsylvania	10.3	10.4	11.1	11.0	10.6	15.7	16.2	15.8	15.7	15.5	44	46	50	50	50	3.2	3.5	4.0	4.6	4.9
Rhode Island	11.4	12.2	12.2	12.2	11.5	15.2	15.4	14.9	14.9	14.9	40	44	50	49	47	3.2	2.5	3.4	4.1	4.3
South Carolina	10.0	10.3	10.7	11.2	10.9	21.6	21.1	20.3	21.0	22.1	68	81	81	80	79	5.9	7.7	7.8	7.9	9.5
South Dakota	8.3	7.0	8.9	8.9	9.1	16.8	17.0	16.8	18.6	19.0	41	45	52	48	50	3.0	3.5	4.2	4.1	5.5

Texas	8.8	9.8	10.6	10.8	10.1	18.2	19.6	18.8	18.2	18.9	62	65	74	71	72	4.7	5.6	5.7	6.9	7.3
Utah	8.9	9.2	9.4	9.9	9.8	24.3	25.4	24.0	24.3	24.7	37	45	41	53	49	2.8	3.2	3.3	4.4	4.0
Vermont	10.8	10.8	11.4	13.0	12.7	14.7	14.6	14.2	17.0	17.5	36	43	45	58	49	3.3	3.0	8.1	5.0	6.8
Virginia	10.3	10.5	10.7	11.3	10.8	18.6	19.1	18.7	19.0	19.3	62	69	64	67	64	4.9	5.1	5.0	5.1	5.3
Washington	11.1	11.0	11.5	11.7	11.2	15.2	15.7	14.8	13.9	13.7	38	39	40	46	45	3.8	3.6	4.8	5.2	5.2
West Virginia	9.1	9.4	10.3	10.8	10.1	21.6	22.4	22.6	22.3	23.0	55	62	62	71	61	3.5	3.6	4.9	5.3	5.2
Wisconsin	10.5	10.3	10.9	11.3	10.5	18.1	18.3	17.9	17.7	17.6	40	42	44	47	47	2.8	2.9	3.5	4.0	3.7
Wyoming	9.3	9.4	10.6	10.3	9.8	20.5	20.2	19.6	20.4	15.8	45	53	53	58	51	3.5	3.5	3.5	5.0	4.1

[1] Data not available prior to 1937.

[2] Data not available.

TABLE 4.—*Trend of death rates for various causes per 100,000 population*

RATES PROVISIONAL FOR ALL YEARS[a]

State	Typhoid and paratyphoid fever (1, 2)					Measles (7)					Scarlet fever (8)					Whooping cough (9)				
	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1933	1937	1933	1935
Alabama	1.6	2.0	1.9	2.7	2.9	2.0	5.8	0.1	0.7	5.2	0.5	0.6	0.4	0.4	0.5	5.7	5.8	6.5	2.6	4.8
Alaska[1]	(3)	1.6	1.7			60.0	1.6	5.0			9.2	1.6	1.7			29.2	60.3	36.7		
California	.7	1.0	1.0	1.2	1.4	1.0	1.0	.5	2.4	1.1	.5	.4	.8	1.6	1.1	.7	2.2	.8	2.1	1.0
Colorado	1.9	2.1	3.0	3.1	3.5	1.3	2.8	.5	.7	9.9	1.0	1.1	2.0	7.1	11.8	4.7	4.3	4.7	4.1	4.1
Connecticut	.3	.4	.3	.5	.8	.5	.1	.7	.4	1.9	.2	.2	.6	.6	1.3	1.3	.7	1.4	1.8	1.2
Delaware	2.7	1.5	2.2	2.7	2.3	(3)	.5	1.5	3.1	1.2	.4	.3	.4	1.0	.4	3.9	5.3	6.5	5.0	2.0
District of Columbia	.8	.9	1.9	1.6	2.7	.3	.3	2.1	1.3	(3)	.2	.5	.8	.3	1.3	2.3	.9	2.7	8.4	.5
Florida	1.6	2.7	2.9	2.5	3.8	.8	1.6	.3	.1	1.9	.3	.2	.1	.1	.1	3.4	3.8	3.5	1.5	3.7
Georgia	2.6	3.8	4.3	6.2	5.3	1.6	4.8	.3	.2	.9	.1	.1	.4	.5	.7	4.0	7.2	4.6	2.0	4.9
Hawaii	1.7	2.2	1.6	2.0	2.4	(3)	.2	41.7	6.2	(3)	(3)	.2	(3)	(3)	(3)	6.4	4.8	2.2	.4	2.6
Idaho	3.2	3.0	1.8	2.5	2.5	.8	.8	2.8	2.3	2.1	.1	1.0	1.5	10.3	6.1	2.0	2.8	3.2	1.6	6.9
Illinois	1.4	.7	.6	.9	1.2	(4)	2.6	.4	.1	3.7	.9	1.7	2.0	3.0	5.2	2.0	2.1	1.9	1.9	2.7
Indiana	1.1	.7	1.1	1.7	1.5	.2	3.0	.4	.1	2.6	1.1	1.9	2.7	3.3	3.1	1.7	1.3	4.6	1.6	3.9
Iowa	.6	.7	.9	1.2	1.3	1.1	1.0	.2	.1	6.0	.9	1.8	4.5	2.1	2.8	1.6	2.6	3.3	1.4	1.7
Kansas	.7	.7	.9	1.7	1.6	.2	1.2	.2	.2	12.0	.7	1.4	3.0	4.1	2.4	.1	2.7	2.4	.9	2.8
Kentucky	4.1	4.7	5.4	7.4	8.9	1.0	3.6	2.9	2.7	8.2	1.0	1.5	1.7	1.6	2.6	2.3	6.3	8.2	2.6	9.7
Louisiana	6.3	5.4	6.3	7.0	9.2	4.4	1.0	.8	2.1	6.0	.2	.3	.5	.2	.4	5.3	4.3	6.8	4.7	3.2
Maine	1.0	1.9	1.6	.8	2.0	.6	2.1	.4	2.5	7.0	.3	(3)	.5	.8	1.2	3.5	2.9	3.0	2.7	3.6
Maryland	1.0	1.9	1.8	1.7	2.7	.9	.5	2.3	1.6	1.4	.3	.5	.9	.7	1.7	1.2	3.0	5.5	5.1	2.6
Massachusetts	.3	.3	.2	.2	.3	.4	.3	.6	.8	.8	.3	.5	.8	1.0	1.4	1.0	.8	2.1	1.2	1.6
Michigan	.6	.6	.6	.8	.7	.6	2.1	.2	.3	3.9	1.4	1.8	3.0	2.4	2.0	1.6	2.3	2.7	2.2	2.8
Minnesota	.1	.3	.3	.5	.6	2.4	.9	.3	.9	2.4	.6	1.0	1.5	1.1	3.0	.7	1.8	2.8	1.2	2.4
Mississippi	2.1	3.4	3.8	4.9	3.2	3.9	3.8	3.0	1.1	1.0	(3)	.4	.2	.3	.6	7.2	7.2	5.3	2.5	3.7
Missouri	2.4	2.8	4.2	5.2	3.7	.2	4.9	.5	.4	3.8	.8	1.1	2.8	2.2	1.7	1.7	4.3	4.7	1.7	4.4
Montana	2.2	.9	2.0	1.9	2.4	2.9	2.0	.7	.6	9.2	1.6	1.8	2.0	8.7	4.0	2.9	8.5	2.6	3.0	4.3
Nebraska	.4	.5	1.0	.9	.4	1.0	.8	.3	.7	6.2	1.0	1.1	2.6	4.8	2.9	1.0	2.6	2.0	1.7	1.2
Nevada	1.0	2.9	(3)	2.0	3.0	1.9	(3)	(3)	(3)	3.0	(3)	(3)	2.0	8.0	1.0	(6)	2.9	2.0	4.0	3.0
New Jersey	.4	.4	.6	.7	.6	.1	.7	1.2	.3	1.3	.5	.3	.3	.7	.6	1.1	1.3	1.1	1.3	2.3
New Mexico	4.0	5.0	6.6	8.5	11.6	.9	12.1	10.2	2.8	9.0	.5	1.2	1.7	4.7	1.4	8.7	14.9	11.4	7.6	21.9
New York	.3	.5	.5	.6	.5	.4	.7	.4	1.0	1.5	.4	.5	.8	1.4	1.5	1.0	1.4	1.3	1.1	2.5
North Carolina	1.3	2.0	2.3	2.2	2.3	1.5	7.0	1.1	.3	2.0	.4	.8	.5	.7	.6	6.3	7.5	4.9	1.1	8.8
North Dakota	.6	.3	.4	.6	1.3	3.1	2.7	(3)	.4	7.5	1.0	2.5	1.7	4.7	4.3	1.8	5.9	1.4	.6	6.1
Ohio	.8	.3	1.5	1.8	1.5	.1	2.6	1.5	.6	2.3	1.1	1.2	1.9	2.4	3.6	1.2	1.8	4.3	2.8	2.7
Oklahoma	3.5	3.8	5.3	5.2	7.5	2.9	2.2	.9	.6	1.8	.6	.9	1.3	1.7	.9	.9	7.2	3.3	1.6	6.2
Oregon	1.5	.5	.5	1.7	1.5	.8	.5	.1	4.1	1.5	.5	1.0	1.0	1.8	2.1	.5	2.0	2.1	2.0	1.7
Pennsylvania	.6	.9	1.1	1.0	.8	1.1	2.3	.8	.3	2.2	.6	1.2	1.5	1.0	1.9	1.4	1.6	2.6	1.5	2.0
Rhode Island	.1	.4	.1	.4	.3	.1	(3)	.4	.7	1.0	(3)	.4	1.6	1.9	.4	2.1	1.2	3.1	1.0	1.2
South Carolina	5.1	6.4	6.4	10.0	10.3	.5	7.6	.9	.4	1.3	.2	.5	.3	.6	.4	6.4	14.2	4.5	3.5	9.5
South Dakota	1.2	1.2	1.0	1.0	1.4	4.0	.7	(3)	.3	1.0	1.2	1.0	2.9	3.6	2.7	.9	7.4	3.0	.6	4.0
Tennessee	3.2	3.7	4.8	5.0	6.4	1.4	6.8	1.1	.8	1.3	.6	.7	.7	.8	1.0	3.3	6.9	4.7	2.5	13.4

Texas	4.5	6.3	6.4	6.5	8.9	1.3	1.8	3.5	2.7	2.6	.3	.5	.8	1.0	1.0	3.4	6.0	5.9	2.2	3.4
Utah	.4	.4	.8	1.6	.8	.4	2.1	.8	1.2	6.2	.4	1.0	1.7	8.5	12.0	1.2	2.9	2.7	4.3	7.8
Vermont	.3	.3	1.0	1.6	1.1	1.5	3.1	(3)	5.8	1.6	1.0	.3	.3	.8	2.1	6.2	2.8	.8	2.6	3.4
Virginia	1.7	2.0	1.9	2.7	2.8	.8	3.3	2.4	1.1	5.1	.3	.3	.2	.5	.9	5.5	6.8	7.8	4.4	7.5
Washington	1.1	.8	.7	1.1	1.0	.9	.2	.8	2.0	1.5	.7	.5	1.0	1.5	1.5	.2	2.0	1.9	.8	1.9
West Virginia	2.9	3.5	4.4	4.2	5.3	.3	6.1	2.1	1.6	6.4	1.1	2.0	1.9	2.2	4.5	2.1	7.1	13.1	3.9	6.9
Wisconsin	.2	.2	.4	.4	.3	.7	1.2	.2	.4	2.5	1.2	1.3	2.3	4.4	3.8	1.5	1.9	2.2	1.4	1.8
Wyoming	2.9	2.1	1.3	.4	2.6	.4	(3)	.4	(3)	13.4	.4	2.5	3.8	9.4	11.2	.4	13.9	5.1	1.3	6.9

[1] Data not available prior to 1937.

[3] No deaths reported.

[4] Less than 1/10 of 1 per 100.000 population.

TABLE 4.—*Trend of death rates for various causes per 100,000 population*—Continued

State	Diphtheria (10)					Acute poliomyelitis and polioencephalitis (16)					Encephalitis, epidemic or lethargic (17)					Epidemic cerebrospinal meningitis (18)				
	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935
Alabama	2.7	3.6	3.4	4.0	4.5	0.5	0.6	0.6	1.3	0.5	0.3	0.5	0.1	0.3	0.7	0.8	2.1	3.9	0.9	0.8
Alaska [1]	1.5	3.2	(3)	----	----	(3)	1.6	3.3	----	----	1.5	(3)	1.7	----	----	(3)	(3)	15.0	----	----
California	.9	1.6	1.7	2.1	2.2	1.2	.3	1.3	.6	1.1	.5	.6	.8	.6	.4	.5	.8	1.6	2.1	2.1
Colorado	3.0	3.3	3.2	3.4	4.0	1.1	.7	4.5	1.4	1.1	.6	1.6	1.0	1.0	.7	.7	.6	3.1	2.8	2.2
Connecticut	.3	.7	1.4	.4	1.0	.1	(3)	.4	.1	1.3	.1	.1	.4	2	.3	.2	.2	.7	.7	1.9
Delaware	.8	.8	.4	1.2	2.0	.4	.4	.4	.4	.4	1.1	(3)	.4	.4	.4	1.5	.4	1.5	1.2	.8
District of Columbia	.8	1.1	2.2	4.5	4.7	.2	.5	.6	.3	1.7	.2	.5	.8	.6	.8	.6	1.4	4.8	10.5	15.8
Florida	2.0	2.0	3.2	3.5	3.7	.3	.6	.3	.4	.4	.4	.5	(3)	.5	.1	.6	.9	4.0	3.7	.8
Georgia	2.8	3.3	3.4	3.8	5.2	.5	.3	.6	.9	.5	.1	.3	.2	.3	.1	.4	.6	1.2	2.1	1.0
Hawaii	.9	.4	2.4	1.6	.7	1.3	.4	.4	.2	(3)	.2	.4	.2	.7	.2	.4	.4	.4	1.6	.7
Idaho	.8	.6	1.2	.6	.6	1.6	.2	.4	1.0	.8	1.6	1.2	.8	1.2	2.5	1.8	1.8	1.0	6.0	4.6
Illinois	1.5	1.5	1.9	2.2	2.6	.3	.2	1.1	.9	.5	.2	.4	.4	.4	.5	.2	.3	1.2	2.2	2.6
Indiana	1.5	2.4	1.5	2.9	4.0	.1	.3	.8	.4	.3	.5	.7	.5	.6	.7	.3	.7	1.5	2.1	2.5
Iowa	.5	.9	.4	.9	2.1	1.1	.4	1.5	.5	.4	.7	1.0	.6	.5	.7	.4	.6	1.0	2.0	2.0
Kansas	.4	1.0	1.3	2.3	2.1	.3	(3)	1.9	.6	.5	1.7	1.2	1.2	1.1	1.4	.4	.3	1.3	1.1	2.2
Kentucky	3.0	3.8	4.6	5.1	8.3	1.2	.9	1.1	1.2	1.6	.7	.3	.7	.8	.5	1.1	2.1	2.9	6.2	2.6
Louisiana	3.2	3.5	3.3	4.4	5.2	.4	.5	.9	.4	.6	.3	.4	.3	.2	.4	.6	.9	1.3	1.8	1.0
Maine	2.1	2.0	.6	.3	1.1	.7	.5	1.8	.4	1.7	.6	.1	.2	.2	.5	.3	.1	1.1	.9	.5
Maryland	1.2	1.1	1.3	1.6	1.3	.1	.1	1.0	.1	.2	.4	1.0	1.5	1.1	.8	.6	.8	2.7	7.1	5.2
Massachusetts	.3	.4	.4	.6	.7	.1	.2	.5	.2	1.4	.1	.2	.3	.3	.5	.4	.6	1.5	2.3	1.2
Michigan	.5	.9	1.5	1.1	1.2	.8	.2	1.0	.4	.7	.1	.2	.2	.4	.3	.3	.4	.8	1.2	.9
Minnesota	.4	.5	.5	.6	.6	1.9	.3	1.9	.2	.4	.3	.7	.5	.6	.9	.2	.4	.9	1.9	1.7
Mississippi	2.7	4.1	2.8	3.6	4.6	.6	.9	2.9	1.0	.5	.2	.4	.6	.3	.2	1.1	.6	1.2	1.3	1.3
Missouri	1.9	3.0	2.3	2.0	4.6	.5	.4	1.9	.6	.4	.4	.5	3.1	.8	1.0	.4	.5	1.[illegible]	2.0	2.[illegible]
Montana	1.6	1.7	1.5	2.1	2.8	(3)	.4	1.3	.6	.2	1.5	5.5	.9	.4	.9	.9	1.8	1.5	4.3	2.6
Nebraska	1.0	1.2	1.1	1.5	1.2	.8	.5	3.2	.7	.7	.4	.8	.9	.4	.5	.2	.4	1.1	1.4	2.8
Nevada	(3)	2.9	(3)	1.0	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	1.0	1.0	1.6	(3)	1.0	[illegible]	2.[illegible]
New Jersey	.6	.7	.7	.5	1.1	.6	.2	.5	.2	.8	.5	.7	.6	.8	.6	.4	.5	1.1	1.8	.7
New Mexico	3.5	4.0	4.3	3.8	5.7	1.9	.9	1.7	1.7	.9	.5	(3)	(3)	.7	.2	1.2	.9	1.2	3.3	5.[illegible]
New York	.2	.3	.6	.5	.8	.4	.2	.4	.1	1.1	.4	.7	.7	.5	.6	.5	.8	1.2	2.2	2.[illegible]
North Carolina	4.9	5.1	4.8	5.5	4.6	.3	.3	.6	.3	2.0	.2	.4	.4	.4	.4	.4	.9	1.2	1.6	.8
North Dakota	1.8	.8	1.6	1.6	3.0	.3	(3)	(3)	.4	.4	1.5	3.8	.6	.7	1.1	.4	1.3	1.8	1.0	1.[illegible]
Ohio	.9	1.4	1.6	1.6	2.7	.2	.3	.8	.8	.5	.6	.4	1.0	.5	1.0	.2	.7	1.4	2.4	3.[illegible]
Oklahoma	3.0	4.8	3.8	3.5	5.7	.4	.9	2.3	1.4	.4	.5	.3	.3	.7	.3	.5	.9	1.9	3.7	2.[illegible]
Oregon	.2	1.0	.8	.9	.5	.4	.6	.7	.9	1.6	.8	1.4	1.2	1.9	1.7	.7	1.3	.7	1.5	2.8
Pennsylvania	.7	1.0	1.0	1.3	1.5	.4	.1	.4	.2	.3	.5	.7	.6	.6	.7	.6	.6	1.3	1.2	1.[illegible]
Rhode Island	.1	.1	.4	.1	.7	(3)	.1	(3)	(3)	3.5	(3)	.6	.3	.3	1	[illegible]	.9	2.2	3.1	2.[illegible]
South Carolina	1.3	2.8	3.5	4.0	3.7	2.2	.5	.7	.9	.7	.2	.4	.3	.2	.4	.4	.8	1.9	2.5	1.[illegible]
											.6	1.0	1.2	.3	.6	.7	.3	1.0	.6	[illegible]

Tennessee	3.0	3.6	4.7	5.3	6.4	.5	.7	1.2	1.5	.8	.6	.4	.8	.9	.5	.7	1.7	2.4	3.6	3.8
Texas	2.7	3.9	3.9	5.6	7.7	1.1	.7	2.1	.6	.8	.3	(3)	(3)	(3)	(3)	.3	.6	1.5	2.1	1.4
Utah	1.0	1.2	1.2	1.0	1.4	1.3	(3)	1.3	.2	.2	1.0	.2	1.0	.6	.6	1.0	1.3	1.7	3.5	1.9
Vermont	.8	3.4	.5	(3)	1.1	1.3	1.0	.5	(3)	1.9	.3	.3	(3)	.5	.5	.5	(3)	2.3	1.6	2.1
Virginia	3.5	4.2	3.1	3.8	4.3	.3	.3	.5	.4	1.6	.3	.2	.6	.4	.5	.9	1.5	4.0	5.2	3.8
Washington	.7	.6	.9	.4	.7	.4	.2	.5	1.0	.6	1.5	1.3	1.9	2.4	1.6	.5	.7	1.3	1.5	2.1
West Virginia	3.1	3.5	4.8	7.1	8.7	.5	.8	1.1	1.2	.6	.6	.5	.2	.5	.6	1.9	1.7	4.4	5.8	3.6
Wisconsin	.1	.5	.8	.5	.4	.4	.2	1.3	.1	.2	.3	.3	.5	.8	.8	.2	.3	.7	1.0	1.2
Wyoming	1.3	3.0	(3)	3.9	.9	1.3	1.3	3.0	.4	.9	(3)	.8	1.7	.8	1.3	.8	.8	2.6	2.1	2.6

[1] Data not available prior to 1937.

[3] No deaths reported.

TABLE 4.—*Trend of death rates for various causes per 100,000 population*—Continued

State	Influenza (11)					Pneumonia, all forms (107–109)					Malaria (38)*					Pellagra (62)*				
	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935
Alabama	32.9	25.6	49.9	48.5	44.3	65.8	75.6	90.2	97.8	85.7	6.9	7.6	7.9	12.2	11.4	9.6	11.8	10.7	10.7	9.1
Alaska [1]	24.6	41.3	40.0	------	------	167.7	209.5	185.0	------	------	------	------	------	------	------	------	------	------	------	------
California	3.7	4.1	30.4	11.8	8.9	48.4	58.4	81.9	72.3	63.7	------	.1	.2	.1	.1	.7	1.1	1.2	1.4	1.5
Colorado	23.5	13.8	49.2	32.5	32.5	91.4	104.5	167.3	131.3	113.2	------	------	------	------	.1	.1	------	.2	.5	.5
Connecticut	4.6	4.4	11.7	8.0	8.6	41.2	49.3	67.0	70.3	65.1	------	------	------	------	.1	.1	.1	.3	.3	.1
Delaware	12.9	10.7	22.6	10.8	15.6	70.7	68.7	96.2	84.6	91.5	------	------	------	------	------	------	.4	------	------	.4
District of Columbia	9.3	5.2	15.6	7.6	11.4	73.1	86.1	121.4	138.9	127.3	.2	------	------	------	.7	.2	.6	.8	.5	1.3
Florida	29.8	21.9	29.5	53.5	30.2	60.6	72.6	73.4	85.5	67.7	6.6	9.4	12.3	21.0	20.2	4.4	6.0	6.2	8.1	11.1
Georgia	28.9	24.7	44.6	55.9	43.0	68.4	84.4	93.7	120.3	95.8	3.0	4.8	6.9	20.0	12.6	8.4	11.5	11.7	12.6	12.1
Hawaii	3.4	4.8	8.2	11.9	13.2	48.2	67.2	83.5	68.0	69.4	------	------	------	------	------	------	------	.4	.3	------
Idaho	18.0	16.6	39.0	19.0	17.1	58.2	77.8	77.3	110.5	95.6	.2	------	------	------	.4	.4	------	------	.2	------
Illinois	12.2	5.6	16.9	14.5	15.7	53.7	58.2	70.0	80.4	77.9	.4	.4	.5	.7	.8	.3	.2	.2	.2	.2
Indiana	25.4	12.3	32.3	28.1	21.7	67.1	65.7	91.7	97.0	86.4	.2	.3	.6	.1	.3	.1	.1	.5	.5	.2
Iowa	23.4	12.5	32.2	19.9	21.0	49.6	69.4	64.4	71.2	76.2	------	(4)	.1	.1	(4)	.2	------	.2	(4)	(4)
Kansas	18.2	15.4	34.0	47.3	31.2	42.2	50.2	59.5	84.3	79.4	------	.2	.2	------	.3	.3	.3	.4	.7	.3
Kentucky	32.0	24.2	48.2	43.3	28.8	69.2	72.3	89.2	124.4	83.0	1.0	1.1	1.3	1.8	2.5	2.7	2.1	2.6	3.1	2.6
Louisiana	25.2	25.1	53.6	49.5	24.2	87.5	98.3	105.7	120.0	87.2	5.4	8.6	8.4	11.7	17.0	3.8	6.9	4.6	5.5	6.3
Maine	19.8	14.9	37.5	24.9	20.2	72.7	73.9	93.5	98.4	84.3	------	------	------	------	.1	.5	.2	.1	.1	.5
Maryland	10.3	7.9	17.3	11.7	14.7	72.0	80.0	108.8	111.0	100.7	------	.2	.1	.1	.2	.5	.3	.4	.5	.8
Massachusetts	4.9	3.5	9.5	6.3	7.3	65.2	71.9	92.6	83.1	89.5	(4)	(4)	(4)	------	(4)	.1	.2	.3	.3	.4
Michigan	15.3	6.5	17.7	12.0	15.1	57.1	58.9	84.9	85.4	80.4	(4)	(3)	------	.1	.2	(4)	.1	(4)	.1	.2
Minnesota	12.1	9.0	23.8	14.2	15.8	60.6	63.3	74.8	85.0	76.5	------	------	------	(4)	.1	------	.1	.1	.1	.2
Mississippi	39.7	81.8	59.0	71.3	42.4	59.2	70.9	91.4	92.0	70.4	10.2	13.5	15.4	18.0	26.4	9.3	13.2	11.6	13.4	11.2
Missouri	18.7	14.1	34.4	38.7	24.0	72.5	82.7	110.1	116.7	98.8	1.6	1.9	2.3	2.6	4.2	.7	.6	.5	.9	.4
Montana	23.6	19.4	55.5	24.3	42.0	67.1	76.0	104.1	121.5	122.8	------	------	------	.2	------	.2	------	.2	.2	------
Nebraska	16.5	11.0	41.1	21.3	22.7	49.9	53.2	60.8	72.0	78.2	------	------	------	------	.2	------	.1	.2	.1	.1
Nevada	6.8	1.0	8.9	26.0	21.2	56.4	107.8	124.8	148.0	108.1	------	------	------	------	------	1.0	------	1.0	------	------
New Jersey	5.5	4.6	10.0	7.9	9.2	42.0	54.9	68.4	67.7	63.2	(4)	------	------	(4)	.2	.1	.2	.2	.2	.1
New Mexico	24.4	13.0	33.9	34.8	41.5	103.1	96.0	128.2	144.8	132.2	.9	.2	(3)	.5	.9	3.5	4.3	4.3	5.0	2.4
New York	4.2	3.6	10.1	6.5	6.8	55.9	63.0	87.6	88.9	85.4	.2	.3	.2	.1	.1	.2	.2	.2	.2	.2
North Carolina	17.8	14.0	25.1	32.2	25.3	61.0	77.6	84.3	100.7	90.4	1.7	2.2	2.7	4.3	2.7	5.8	7.3	9.4	10.2	11.2
North Dakota	15.9	10.7	27.5	12.7	23.9	49.7	49.9	67.1	55.6	93.3	------	------	------	------	.1	------	------	------	------	------
Ohio	19.0	11.3	30.1	20.0	24.5	61.0	61.7	86.0	87.1	79.0	(4)	(4)	------	.1	.1	.1	------	(4)	.4	.4
Oklahoma	19.9	15.8	40.1	46.1	30.8	55.5	56.8	72.4	91.5	79.3	2.0	3.2	3.3	3.7	5.5	3.8	4.1	4.0	6.9	5.1
Oregon	9.5	8.7	28.7	19.8	15.8	41.9	52.9	62.8	93.3	69.9	.1	------	.2	.1	------	.3	------	.1	.2	.1
Pennsylvania	11.8	9.7	25.6	16.1	18.1	48.3	58.2	78.5	82.5	80.0	(4)	(4)	.1	.1	(4)	.1	.1	.1	.1	.1
Rhode Island	5.3	4.8	11.0	9.1	8.5	59.5	81.4	94.7	95.9	79.4	------	------	------	------	------	.3	------	.1	.1	.3
South Carolina	29.4	28.4	42.5	49.8	44.2	63.7	85.2	91.9	87.4	89.7	9.0	11.8	14.0	23.4	23.4	7.8	12.1	14.4	14.8	16.2
South Dakota	19.8	13.9	38.7	20.2	31.6	51.2	52.5	70.1	66.2	93.1	------	------	------	------	------	------	------	------	.1	------

Tennessee	31.3	25.4	44.9	54.4	39.9	60.3	78.9	93.3	117.3	95.4	3.3	3.5	3.6	5.4	7.8	5.0	7.0	6.9	8.5	7.6
Texas	21.1	24.8	52.9	53.2	39.2	53.8	70.4	86.5	100.8	83.8	2.2	4.1	5.8	8.1	10.6	5.8	8.8	9.4	11.7	10.6
Utah	13.4	9.8	24.1	21.5	22.7	47.4	65.8	63.8	95.7	92.9	------	------	------	------	.2	.2	------	.2	------	.2
Vermont	23.9	13.2	30.0	31.1	35.0	73.0	73.6	97.1	111.8	99.4	------	------	------	------	------	------	------	.3	------	.8
Virginia	21.4	18.3	38.7	58.0	35.2	64.6	69.0	94.6	94.0	78.7	.3	.1	.3	.6	.6	2.1	4.1	3.8	4.9	5.3
Washington	8.7	10.4	24.2	26.0	16.2	72.0	63.9	69.7	76.9	56.8	------	------	------	------	------	------	------	.2	.3	.1
West Virginia	19.2	18.5	42.1	33.[illegible]	31.1	60.6	69.2	92.1	109.3	84.1	------	.1	.1	.1	.2	.3	.3	------	.5	.7
Wisconsin	18.3	8.1	39.4	15.9	19.3	50.5	57.5	67.7	77.0	65.5	------	------	------	.1	(4)	.1	.2	.1	.1	------
Wyoming	11.7	13.1	46.0	24.0	26.7	51.9	65.0	115.3	112.3	91.8	------	------	------	------	.4	.4	------	------	------	------

[1] Data not available prior to 1937. [3] No deaths reported. [4] Less than 1/10 of 1 per 100,000 population. *Leaders indicate no deaths reported.

TABLE 4.—*Trend of death rates for various causes per 100,000 population*—Continued

State	Tuberculosis, all forms (23–32)					Cancer, all forms (45–53)					Diabetes mellitus (59)					Cerebral hemorrhage, apoplexy (82a, b)				
	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935
Alabama	52.7	54.9	60.4	63.9	61.2	57.6	56.9	57.2	59.2	60.3	11.7	12.0	10.4	12.3	9.1	67.0	68.8	67.0	69.2	66.2
Alaska [1]	401.5	460.3	423.3			87.7	74.6	71.7			4.6	1.6	6.7			66.2	141.3	71.7		
California	61.7	65.4	72.0	76.2	75.3	152.5	147.7	140.9	144.9	140.6	25.9	25.0	25.5	24.0	25.0	91.5	89.2	85.1	85.1	84.7
Colorado	57.4	59.3	65.9	76.2	76.8	116.5	116.6	113.9	116.7	112.2	18.8	17.6	16.5	18.4	16.1	89.5	88.4	85.6	84.5	80.6
Connecticut	33.4	35.6	36.5	38.6	41.9	134.8	138.5	125.8	125.1	126.4	28.4	29.2	30.6	28.3	29.8	79.9	85.3	85.4	83.3	84.3
Delaware	57.4	50.0	55.6	49.4	62.5	109.9	117.2	118.8	122.0	114.1	33.8	33.6	29.9	29.3	30.5	116.0	97.7	113.8	113.9	109.4
District of Columbia	66.7	71.3	88.5	106.6	102.2	158.0	136.9	139.1	136.7	131.0	27.1	25.8	28.7	26.7	26.1	84.6	83.3	95.2	100.6	99.5
Florida	53.3	57.7	57.5	54.6	55.5	99.8	89.3	97.3	88.4	87.9	22.2	19.2	17.7	18.6	19.5	106.2	101.7	113.7	112.5	104.8
Georgia	46.1	50.0	49.3	55.1	55.7	61.0	60.2	57.1	56.0	54.8	11.3	13.0	12.0	12.5	12.3	92.5	81.6	83.1	82.7	76.7
Hawaii	59.5	58.3	70.8	78.0	68.5	63.4	60.0	66.5	62.9	62.1	14.8	15.1	15.6	16.9	15.1	42.4	49.1	40.6	43.7	39.8
Idaho	19.2	19.8	20.7	24.5	24.6	91.5	84.8	83.4	79.6	66.8	20.6	11.0	12.6	13.6	14.2	62.6	62.6	70.0	73.6	66.2
Illinois	45.5	46.6	50.7	51.6	52.1	141.1	136.1	131.2	131.1	128.4	29.8	27.5	27.1	29.2	25.3	74.7	73.1	71.6	79.1	72.8
Indiana	40.4	38.3	45.4	47.0	46.2	109.5	110.7	106.7	108.0	109.9	16.2	15.6	14.5	16.4	15.5	129.1	119.9	118.7	127.4	121.8
Iowa	17.2	18.1	20.2	22.2	25.7	122.7	126.7	124.3	120.8	126.2	24.2	21.6	21.4	23.2	21.5	101.6	93.3	103.4	105.2	105.7
Kansas	22.7	23.1	26.6	29.0	28.8	119.9	121.4	115.6	117.2	111.2	25.7	24.1	23.3	22.9	22.2	97.4	100.2	97.8	102.7	98.9
Kentucky	66.5	66.1	68.8	71.6	69.7	76.9	70.0	68.1	74.6	71.0	12.3	12.6	10.5	15.1	14.5	100.9	94.9	87.3	83.9	78.4
Louisiana	64.2	66.7	71.0	72.6	72.2	83.6	87.6	81.9	80.7	80.3	17.8	17.6	18.0	17.4	15.8	74.4	69.7	68.2	71.3	63.9
Maine	34.4	29.5	31.5	39.8	35.4	148.7	147.4	143.3	151.3	148.5	26.7	26.8	23.4	28.1	27.7	124.2	112.8	127.2	126.2	123.6
Maryland	76.9	78.9	83.4	82.9	81.1	140.6	136.4	134.4	128.7	130.3	31.1	28.7	26.3	27.5	26.8	102.7	102.4	108.1	110.6	112.3
Massachusetts	33.9	37.2	41.2	43.8	46.3	145.6	154.8	147.9	153.0	147.7	32.1	32.6	33.4	31.4	29.7	94.6	95.8	95.1	96.2	95.3
Michigan	38.5	38.4	43.9	43.9	43.2	123.1	118.6	114.4	115.7	109.6	27.7	26.3	25.9	26.5	26.0	87.2	89.8	86.9	94.8	89.1
Minnesota	29.8	29.1	33.9	35.6	34.6	138.9	140.0	140.6	133.5	131.1	26.8	25.6	23.8	25.8	22.1	95.0	86.0	86.4	86.5	82.7
Mississippi	51.4	57.5	63.7	63.4	58.0	65.4	69.1	65.9	64.6	59.8	12.9	12.9	12.6	12.4	11.9	75.8	73.7	75.9	79.3	67.3
Missouri	44.2	48.0	54.5	58.2	55.2	124.6	123.6	117.8	118.0	117.5	23.3	21.6	21.4	22.6	20.7	87.2	84.8	90.6	91.2	78.2
Montana	43.3	43.3	43.6	41.2	46.9	116.4	100.0	107.2	106.0	97.4	17.5	18.0	20.2	22.4	19.8	90.9	93.8	85.7	92.1	93.6
Nebraska	16.0	15.9	19.1	18.0	22.4	113.9	118.8	112.2	113.0	108.5	24.2	24.7	26.0	24.8	20.5	88.3	82.9	83.3	89.4	99.3
Nevada	55.3	60.8	85.1	88.0	108.1	118.4	103.9	70.3	95.0	89.9	9.7	12.7	13.9	13.1	17.3	70.9	80.4	74.2	69.0	80.8
New Jersey	41.1	43.8	46.4	50.2	50.1	133.4	127.5	124.8	127.4	123.8	32.0	29.2	30.3	30.6	28.6	82.4	80.3	73.3	50.8	75.9
New Mexico	89.2	93.1	126.3	122.0	121.1	65.0	64.0	57.1	55.7	54.0	10.6	8.8	8.1	8.8	8.5	47.7	52.1	51.4	49.8	48.1
New York	48.5	50.0	57.1	58.4	57.3	156.0	155.4	150.5	147.3	143.3	39.5	36.4	37.0	36.3	32.7	67.6	64.9	74.6	78.7	77.3
North Carolina	50.7	53.2	54.1	60.6	56.6	55.8	54.1	54.1	51.8	50.6	13.7	10.8	10.9	11.6	10.1	79.7	81.2	79.2	91.2	80.7
North Dakota	19.9	19.8	25.9	24.9	25.1	89.0	86.7	80.7	83.5	79.7	19.9	19.2	17.6	18.8	18.6	70.6	63.1	67.4	67.6	58.3
Ohio	43.3	45.8	49.4	52.9	53.8	134.4	129.5	121.3	126.4	123.3	29.7	27.4	26.4	27.4	25.9	109.8	105.7	107.8	113.8	109.2
Oklahoma	41.4	44.7	48.3	51.2	46.1	71.3	68.8	71.8	67.6	60.5	13.3	12.6	12.8	14.6	12.3	77.8	62.1	62.2	63.9	60.3
Oregon	30.2	29.0	33.9	36.5	34.5	132.8	137.2	121.5	135.1	122.9	26.2	24.0	25.0	23.3	25.0	110.8	102.3	101.9	108.4	108.0
Pennsylvania	38.7	40.7	45.3	44.4	44.4	118.7	116.5	115.0	112.0	107.0	32.5	30.0	30.8	27.4	27.2	80.2	80.1	79.4	86.5	81.9
Rhode Island	38.9	40.7	46.8	47.9	51.0	156.7	159.2	156.2	145.2	147.3	38.3	41.6	42.1	33.8	33.3	90.9	96.9	96.4	98.4	96.2
South Carolina	44.0	48.5	50.4	53.2	54.3	54.2	53.8	50.3	49.4	49.1	13.4	12.0	11.5	11.0	12.2	95.3	92.6	93.5	106.2	84.3
South Dakota	27.3	34.4	37.3	34.4	39.2	97.5	86.1	84.0	88.4	89.7	25.0	18.5	19.6	21.4	19.6	71.1	67.2	69.4	81.9	78.9

Tennessee	77.0	74.7	83.0	87.5	84.3	69.5	71.6	67.3	65.8	64.6	13.2	10.9	11.2	11.3	11.5	79.2	79.5	78.8	80.3	77.4
Texas	57.9	66.9	69.5	71.5	69.1	68.7	74.4	72.8	73.6	68.5	12.0	12.2	12.6	12.7	11.7	61.4	70.8	69.3	62.2	64.8
Utah	17.1	19.0	20.4	21.5	17.5	96.4	88.5	91.3	81.2	85.2	19.2	20.8	19.1	20.3	17.9	56.8	54.3	69.3	50.0	52.8
Vermont	36.0	34.5	47.2	42.6	42.6	129.6	123.6	137.6	137.6	139.5	30.1	28.5	18.8	25.5	30.8	106.9	103.1	96.9	115.2	120.1
Virginia	57.7	63.9	60.5	66.6	69.1	77.1	77.4	70.9	71.1	72.1	16.8	15.9	16.0	15.4	15.2	109.0	93.4	88.8	95.7	95.1
Washington	42.6	42.8	46.3	49.8	51.6	142.0	135.4	132.0	133.3	132.2	25.9	24.7	23.5	25.3	23.3	108.3	106.1	102.2	103.8	98.7
West Virginia	45.5	49.1	52.5	54.4	57.3	73.5	73.6	73.6	70.6	79.9	17.3	16.0	15.1	14.6	13.4	76.1	71.7	74.0	78.6	71.2
Wisconsin	28.8	31.1	34.8	38.2	36.5	134.4	133.2	132.8	128.7	123.2	28.5	29.6	28.5	29.7	25.8	90.7	89.0	91.1	95.0	88.1
Wyoming	23.8	24.1	15.7	18.0	25.0	78.2	86.5	76.6	73.8	67.2	17.2	14.3	11.1	15.4	17.2	59.8	59.5	84.2	74.2	65.9

[1] Data not available prior to 1937.

TABLE 4.—*Trend of death rates for various causes per 100,000 population*—Continued

State	Diseases of the heart (90–95)					Diseases of the digestive system (115–129)					Diarrhea and enteritis under 2 years (119)					Nephritis, all forms (130–132)				
	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935
Alabama	163.0	166.1	161.9	147.4	135.8	56.2	66.1	64.1	68.0	61.8	13.3	17.8	15.5	17.5	15.2	66.5	76.4	78.0	79.3	79.9
Alaska [1]	252.3	273.0	323.3	------	------	46.2	42.9	65.0	------	------	(³)	(³)	10.0	------	------	30.8	19.0	18.3	------	------
California	365.4	353.3	363.2	333.6	329.5	79.0	77.2	84.8	84.2	77.8	9.6	8.3	12.5	10.4	7.4	74.3	80.0	82.6	83.4	82.6
Colorado	263.3	243.2	210.0	250.0	240.1	67.2	73.3	83.1	101.7	100.5	12.5	14.2	26.6	23.6	17.2	75.5	86.0	79.5	84.3	78.8
Connecticut	287.9	246.5	234.6	238.4	221.7	47.2	48.1	47.6	51.3	56.1	2.0	3.3	3.0	2.6	1.7	74.3	78.2	77.5	84.8	86.8
Delaware	365.0	364.9	303.6	346.3	331.3	52.9	65.3	72.0	63.3	69.9	5.3	12.2	9.6	15.4	19.1	107.2	105.0	136.0	119.3	111.4
District of Columbia	347.6	339.8	327.1	338.4	330.6	82.1	76.2	79.9	84.2	90.2	11.7	11.3	11.6	15.0	9.9	106.2	101.4	98.2	96.9	100.7
Florida	262.6	256.2	241.3	238.4	211.7	82.8	87.7	98.5	85.4	93.2	11.3	12.9	11.0	9.5	12.8	98.3	96.0	100.3	104.4	104.8
Georgia	166.1	164.6	167.3	180.1	163.7	57.2	69.2	67.2	72.6	72.5	13.0	21.8	15.2	17.5	15.8	91.1	109.3	107.7	108.3	100.8
Hawaii	112.4	113.3	107.1	119.4	100.5	47.3	49.1	59.2	64.8	64.2	9.9	11.1	17.0	20.1	18.6	58.0	56.1	64.5	62.2	67.3
Idaho	248.3	207.4	150.7	186.4	159.1	57.6	55.6	71.8	64.7	60.5	5.9	5.9	9.1	7.2	4.4	54.7	53.0	64.2	61.9	62.6
Illinois	336.6	314.0	301.5	317.6	276.7	61.6	64.5	68.9	72.6	69.1	3.1	5.5	4.5	6.5	4.4	91.8	91.5	95.4	102.0	96.8
Indiana	243.7	231.8	243.9	265.5	254.2	(²)	(²)	(²)	(²)	(²)	5.4	8.4	8.5	8.9	6.3	63.1	63.2	63.4	74.3	64.7
Iowa	264.4	242.1	220.5	231.7	225.7	53.2	54.7	54.8	56.9	61.0	2.3	3.4	3.8	4.4	3.9	53.6	56.3	58.3	59.9	62.3
Kansas	249.8	242.0	224.8	241.8	217.0	55.1	60.6	62.5	72.2	70.7	3.9	5.0	6.1	6.8	6.5	93.6	93.8	87.2	97.1	92.4
Kentucky	206.3	178.2	165.2	207.1	185.3	63.2	73.3	71.9	84.0	74.9	18.0	28.8	22.2	30.0	21.7	62.3	68.4	66.0	76.2	72.8
Louisiana	234.5	217.1	211.6	198.9	153.6	72.7	77.0	74.8	81.8	81.5	13.5	17.7	16.5	17.4	17.5	98.9	101.1	104.3	107.7	108.1
Maine	369.4	335.4	359.5	344.4	326.4	54.4	57.7	59.0	66.2	78.3	5.5	7.6	14.0	6.0	12.9	79.8	81.8	81.3	87.1	87.1
Maryland	334.4	327.2	313.8	304.6	273.5	57.4	62.1	69.0	70.3	70.8	10.0	11.9	13.8	16.1	14.0	120.7	132.1	138.6	142.4	137.4
Massachusetts	372.5	364.3	359.2	358.7	337.1	50.9	54.9	59.2	61.5	61.1	1.8	2.7	2.7	3.5	5.2	61.5	67.2	69.0	73.5	76.3
Michigan	303.0	284.2	272.8	278.9	262.8	60.9	62.3	65.6	75.2	67.3	5.5	6.4	5.8	9.8	4.5	57.2	56.8	60.6	63.5	62.9
Minnesota	262.5	248.7	232.4	244.0	213.9	56.3	54.3	56.0	62.2	63.2	3.4	3.4	2.8	4.6	3.8	40.8	42.7	45.4	45.1	48.4
Mississippi	162.6	161.0	155.0	156.7	136.7	61.5	56.4	62.5	63.5	52.5	13.9	18.2	20.7	20.6	13.0	94.4	100.6	101.8	102.4	97.4
Missouri	259.8	252.4	254.2	260.3	229.7	62.8	63.6	62.2	84.6	73.0	8.4	10.7	10.9	15.1	11.6	107.0	100.9	99.3	117.6	111.4
Montana	235.1	212.3	220.8	193.8	205.5	65.7	68.1	73.5	88.5	94.0	5.3	5.9	7.0	11.5	8.1	58.7	46.6	58.1	65.3	66.8
Nebraska	203.1	216.9	219.9	220.6	189.7	49.9	50.9	61.4	74.6	65.6	2.1	2.3	4.0	4.8	3.7	63.6	58.7	63.1	69.6	51.5
Nevada	278.6	279.4	255.4	290.0	218.2	44.7	66.7	72.3	104.0	101.1	3.9	4.9	5.0	7.0	7.1	42.7	39.2	46.5	84.0	100.0
New Jersey	339.2	322.2	308.8	301.9	285.1	53.7	56.2	67.2	58.2	57.0	2.6	3.0	3.2	3.4	3.4	64.4	69.7	70.3	75.6	79.0
New Mexico	133.3	137.7	135.8	128.2	114.2	109.9	116.8	151.2	127.1	134.8	46.7	52.6	88.4	74.4	79.1	54.5	61.6	54.3	67.1	67.8
New York	370.5	364.7	360.9	349.8	318.4	59.9	61.9	67.6	68.3	67.0	4.3	4.7	5.9	6.1	6.2	66.4	70.9	75.5	78.7	80.3
North Carolina	160.4	162.7	158.3	175.1	155.7	63.1	75.9	71.0	64.9	63.9	18.9	29.2	24.6	23.5	22.0	81.9	87.4	84.5	98.1	90.5
North Dakota	187.3	146.8	163.7	160.6	146.0	48.7	48.6	54.8	67.5	65.5	6.3	6.9	10.0	12.2	10.4	37.2	40.3	37.6	41.7	47.4
Ohio	303.1	280.9	284.9	282.8	282.8	56.5	58.6	67.6	73.2	69.2	5.2	6.9	8.2	8.3	6.0	76.9	76.7	78.8	84.4	81.5
Oklahoma	137.8	128.1	129.5	136.9	121.4	65.5	55.8	65.1	70.7	67.0	8.5	9.4	13.0	15.3	13.1	49.5	56.3	61.8	53.0	52.6
Oregon	293.1	273.8	273.3	277.4	277.5	46.2	49.4	52.3	63.2	63.0	2.2	2.0	1.6	2.3	1.8	116.3	109.2	106.6	104.3	103.7
Pennsylvania	312.2	301.5	301.9	292.8	271.7	50.5	53.6	55.5	53.7	55.7	4.3	5.2	6.0	5.8	5.5	79.0	80.0	84.5	82.0	83.1
Rhode Island	376.4	362.6	368.0	355.1	328.3	62.6	62.4	60.6	61.2	66.2	4.1	5.3	5.1	3.8	5.3	99.7	105.3	108.5	107.2	103.8
South Carolina	185.1	187.1	185.2	177.8	178.4	43.1	39.0	29.8	41.6	63.2	7.0	11.0	9.8	16.2	22.1	88.1	90.0	92.0	93.8	93.5
South Dakota	188.0	163.0	167.0	153.6	139.6	56.1	52.0	54.5	60.4	59.0	5.1	5.3	4.6	10.1	7.8	40.0	38.4	44.1	60.5	61.1

Tennessee	170.3	159.3	158.0	161.3	142.6	63.5	74.3	75.2	80.3	77.9	12.5	21.6	17.6	20.4	18.9	58.7	62.5	65.2	67.9	63.1
Texas	168.7	174.2	170.3	168.0	152.4	(2)	(2)	(2)	(2)	(2)	26.1	25.1	31.4	28.8	29.2	53.8	57.6	60.1	61.7	58.0
Utah	244.9	233.8	227.9	218.4	202.5	56.0	66.0	67.8	78.0	80.6	2.3	5.6	3.8	9.9	4.9	56.6	54.4	57.2	58.5	58.3
Vermont	331.9	280.3	311.2	358.3	313.0	47.0	49.7	47.8	69.2	63.9	3.3	2.6	2.6	5.3	3.4	73.5	75.6	72.6	88.2	88.3
Virginia	235.9	227.6	219.2	231.4	208.0	51.0	57.7	51.7	57.8	55.4	10.6	15.6	12.3	13.3	10.8	82.0	80.5	83.5	91.5	86.3
Washington	295.4	281.4	301.9	277.0	264.6	53.4	51.5	47.8	66.3	65.3	2.3	3.2	3.2	3.3	3.7	65.3	67.8	75.3	74.3	79.2
West Virginia	168.8	164.5	166.2	170.5	150.2	61.1	70.3	71.6	92.1	76.8	17.7	25.9	21.3	34.3	20.1	64.4	69.3	66.4	67.3	69.5
Wisconsin	315.5	289.6	282.5	290.8	276.4	(2)	(2)	(2)	(2)	(2)	4.9	5.1	4.7	6.2	4.6	59.8	62.7	68.9	68.8	70.0
Wyoming	217.2	214.8	254.0	207.3	154.9	65.7	70.0	73.6	80.7	75.9	6.3	9.3	14.0	11.6	3.9	72.4	56.5	40.9	53.2	55.2

[1] Data not available prior to 1937.

[2] Data not available.

[3] No deaths reported.

TABLE 4.—*Trend of death rates for various causes per 100,000 population*—Continued

State	All accidents (176–195, 201–214)					Automobile accidents (206, 208, 210)				
	1939	1938	1937	1936	1935	1939	1938	1937	1936	1935
Alabama	67.7	66.8	72.7	70.2	63.6	21.0	20.3	23.4	24.1	21.0
Alaska [1]	160.0	196.8	206.7			(³)	(³)	1.7		
California	96.3	96.8	107.0	108.5	98.0	44.4	43.9	50.9	50.8	46.0
Colorado	90.4	91.2	94.5	103.1	94.3	29.6	31.5	35.9	36.3	31.2
Connecticut	59.6	69.9	63.4	69.7	72.7	20.1	19.1	21.0	25.7	28.1
Delaware	72.2	80.2	106.5	93.4	96.1	29.3	26.7	42.9	33.6	28.1
District of Columbia	76.4	64.3	82.3	82.0	83.8	23.0	20.6	27.5	33.6	27.8
Florida	100.3	98.2	105.1	102.3	119.2	39.3	41.8	42.8	41.6	39.1
Georgia	65.6	66.8	75.3	90.5	79.3	19.8	24.7	29.6	32.3	30.8
Hawaii	42.4	52.6	51.1	59.4	65.0	12.6	16.4	15.0	20.4	18.4
Idaho	100.0	90.0	101.5	111.4	92.1	34.7	34.2	36.7	38.4	34.0
Illinois	70.9	74.1	80.8	99.9	73.5	28.2	27.5	33.1	32.2	29.1
Indiana	70.6	72.3	86.8	105.1	84.5	28.6	30.7	39.3	39.5	35.1
Iowa	64.9	64.9	73.1	87.1	74.9	19.1	18.9	23.9	22.1	24.5
Kansas	99.7	104.3	114.2	95.0	85.9	22.3	24.1	26.9	30.6	31.5
Kentucky	73.3	62.1	71.6	85.8	77.2	21.8	20.8	26.1	23.8	23.7
Louisiana	69.8	71.4	69.4	78.2	73.6	22.2	22.4	22.6	27.2	24.5
Maine	70.3	67.4	74.2	83.5	82.2	21.6	21.7	18.6	24.3	24.8
Maryland	74.4	72.7	92.2	84.9	85.3	23.4	23.0	32.2	27.6	28.0
Massachusetts	67.7	60.0	63.9	69.0	68.7	14.1	15.0	18.9	20.2	19.3
Michigan	76.4	73.5	92.2	99.7	82.7	28.8	28.5	41.0	40.1	35.2
Minnesota	70.0	69.9	75.0	97.8	75.2	22.3	24.1	24.8	26.8	23.7
Mississippi	63.3	67.8	68.6	86.8	66.0	20.5	20.0	22.9	25.9	20.0
Missouri	67.6	67.3	79.2	95.4	74.2	20.2	21.9	27.7	25.6	24.7
Montana	95.5	103.5	108.0	124.3	104.0	27.5	24.6	33.2	32.4	30.0
Nebraska	66.0	57.3	66.5	77.9	82.3	20.6	16.9	24.0	22.8	25.6
Nevada	201.0	141.2	157.3	184.0	177.8	73.8	58.8	59.4	74.0	80.8
New Jersey	56.2	58.4	72.1	72.4	69.0	19.4	20.2	26.6	25.8	27.6
New Mexico	104.9	97.6	125.5	108.2	93.1	47.4	35.1	49.2	49.0	37.2
New York	62.6	65.0	72.6	71.4	70.7	18.0	18.7	22.6	20.4	22.3
North Carolina	64.7	62.6	72.0	71.4	70.6	26.0	24.9	29.9	28.1	29.4
North Dakota	47.0	51.0	55.9	64.1	55.7	13.1	17.4	19.3	19.2	15.7
Ohio	84.6	81.7	94.6	103.2	91.9	28.2	27.9	36.9	35.8	35.5
Oklahoma	74.6	66.9	61.5	76.2	68.9	20.1	21.8	24.2	25.8	26.5
Oregon	95.5	93.9	89.7	109.6	95.9	31.2	31.9	33.2	35.7	28.8
Pennsylvania	62.7	57.3	66.1	78.6	72.2	16.1	16.9	21.6	24.0	23.4
Rhode Island	53.4	94.0	55.9	58.3	60.4	11.3	11.6	18.1	16.5	15.8
South Carolina	68.8	62.9	70.1	75.2	71.9	27.8	24.6	27.9	31.4	27.7
South Dakota	51.2	62.7	60.3	70.5	63.9	20.0	20.2	15.9	18.5	21.4

Texas	62.4	73.9	83.5	82.2	78.9	23.6	29.0	34.0	32.6	30.6
Utah	82.5	97.7	98.4	92.1	91.9	31.3	41.5	38.9	35.9	36.5
Vermont	61.2	64.0	65.5	82.3	92.9	20.3	19.2	17.0	26.3	22.6
Virginia	71.5	68.0	70.8	83.4	82.1	29.0	24.2	28.0	31.2	32.2
Washington	89.9	84.3	99.0	111.4	99.4	27.9	29.0	33.0	38.5	34.6
West Virginia	77.7	79.1	95.1	104.0	99.2	18.4	19.8	24.8	28.0	28.2
Wisconsin	80.6	72.1	83.6	91.2	77.1	24.1	23.5	29.9	26.6	28.6
Wyoming	115.0	113.5	128.9	131.3	124.6	49.4	40.9	53.2	48.9	43.5

[1] Data not available prior to 1937.

[2] No deaths reported.

EXISTENCE AND USE OF HOSPITAL FACILITIES AMONG THE SEVERAL STATES IN RELATION TO WEALTH AS EXPRESSED BY PER CAPITA INCOME[1]

By ELLIOTT H. PENNELL, *Statistician*, JOSEPH W. MOUNTIN, *Senior Surgeon*, and KAY PEARSON, *United States Public Health Service*

In other reports of the series pertaining to the Business Census of Hospitals,[2] distribution of hospital facilities in the United States has been examined in relation to such matters as the geographic locality, population range, and urban character of areas containing hospitals. Repeatedly, through the several investigations, wealth appeared to be such an important factor in regulating distribution of facilities that it seemed worth while to make a special analysis of the bearing of financial resources of a particular region upon the establishment and operation of hospitals therein. From the resulting study came verification of the fact that the presence of hospital facilities and the extent to which they are used depend in great measure upon levels of wealth as reflected by income. Throughout many of the States with limited per capita income, facilities for hospitalization are very meager and the system of financial support in existing hospitals is often so arranged as to deny their benefits to those persons in the income brackets where need is most acute. Obviously, hospitals are scarce within such an area because of collective inability to provide and maintain them; at the same time beds in the few established ones are often unoccupied because of individual inability to pay for their use.

It is the purpose of this investigation to demonstrate the extent of the influence exerted by the relative income of a State or group of States upon the supply of hospital beds and upon the rate of occupancy for these beds, as well as upon the sums expended for their operation. Information which makes possible an evaluation of the relationship between regional financial capacity and the presence and use of hospital facilities flows from two bodies of data: One, assembled by the Bureau of Foreign and Domestic Commerce, makes possible a classi-

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[1] From the Division of Public Health Methods, National Institute of Health

[2] Previous articles based on the 1935 Business Census of Hospitals conducted by the United States Public Health Service are

Pennell, Elliott H, and Mountin, Joseph W The financial support of non-Government hospitals as revealed by the recent Federal Business Census of Hospitals Hospitals, vol 11, No 12, December 1937.

Mountin, Joseph W, Pennell, Elliott H, and Hankla, Emily. A study of the variations in reports on hospital facilities and their use Pub Health Rep, vol 53, No 1, January 7, 1938

Pennell, Elliott H, Mountin, Joseph W, and Hankla, Emily Summary figures on income, expenditures, and personnel of hospitals Hospitals, vol 12, No 4, April 1938

Pennell, Elliott H, Mountin, Joseph W, and Pearson, Kay Prevailing ratios of personnel to patients in hospitals offering general care Hospitals, vol 12, No 11, November 1938

Pennell, Elliott H, Mountin, Joseph W, and Pearson, Kay Business Census of Hospitals, 1935 General Report Supplement No 154 to the Public Health Reports, U S Government Printing Office, 1939.

Mountin, Joseph W, Pennell, Elliott H, and Pearson, Kay Regional differences in hospital facilities for tuberculosis, from the standpoints of accommodations, sources of financial support, and operating costs. Transactions of the National Tuberculosis Association, Thirty-fifth Annual Meeting, June 26-29, 1939, Boston, Mass.

fication of States on the basis of per capita income; the other, secured from the American Medical Association and the Business Census of Hospitals, enumerates type and quantity of hospital facilities by States and describes, along with the degree of their utilization, something of their fiscal structure.

Average per capita income for each State during 1935, 1936, and 1937, as reported by the Bureau of Foreign and Domestic Commerce,[3] was selected as a satisfactory gage of current ability to provide and to use means for hospital care. During an era of economic instability, the advantages of a criterion based on figures for a 3-year interval rather than for a single year are apparent. Information tabulated by the Public Health Service regarding facilities and volume of service has in large part been derived from the hospital number of the Journal of the American Medical Association which was published in the early part of 1938.[4] Since much of the material presented heretofore applies to hospitals so registered, selection of the same group for this analysis permits one to follow with consistency specific items recurring in the several publications.

In order that comparison by areas might be facilitated, the 48 States and the District of Columbia were arranged in descending order of annual per capita income, 1935–37. Such arrangement places the District of Columbia with $1,165 in first position, Indiana with $441 at the median point, and Mississippi with only $196 per capita in last place. As would be expected, industrial States, chiefly of the Northeast, stand high in the array and agricultural ones, especially those of the lower South, rank among the last. Thus ordered, States are analyzed according to provision of hospital facilities and to certain other factors relative to hospitals, such as operating agency and financial structure, which presumably influence their availability.

Tables giving in detail information for each State are supplied in the appendix. For simplicity of discussion there are incorporated in the body of the report summary charts illustrating the measure to which financial resources of different range react on selected aspects of the hospital situation. To this end, States arrayed as described above are divided into four groups, equal in number, which will hereafter be referred to as first, second, third, and fourth quarters, descending order of per capita income prevailing in the respective quarters. It should be explained that the District of Columbia which conforms in economic character with the first or upper one-fourth is added to this class.

Consolidation of States into groups obliterates, of course, in each analysis peculiarities of atypical States. Although examination of

[3] Nathan, Robert R., and Martin, John L.: State Income Payments, 1929–37. Bureau of Foreign and Domestic Commerce, Department of Commerce.

[4] Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938.

the appendix tables treating States individually serves to substantiate the general trends revealed by the summary charts, it shows at the same time that a few States manifest characteristics contrary to those of the majority of States in the same per capita income class. Closer inspection reveals the fact that irregular States are chiefly the thinly settled ones, that is, those with such small populations that ratios based thereon are likely to fluctuate considerably with but slight changes in the basic figures.

Notwithstanding the diversity in kind of medical service offered, hospitals may for convenience be grouped into three major types: General and allied special,[5] mental, and tuberculosis. Mental and tuberculosis hospitals are considered separately since they offer more prolonged treatment than do most of the other types, since they are so organized that patient-day costs of operation are considerably less than for other institutions, and since they operate under a scheme of financial support different from that of general hospitals.

All hospitals under the control of the Federal Government are excluded from the figures contained in this analysis. Source of support and rules governing eligibility for admission to these centers are in great measure distinct from those of other hospitals. Rarely does the matter of residence enter into the question of hospitalization in Federal units. Infirmary departments of institutions, such as colleges, prisons, and homes for the aged, are also omitted from the study. They, like Federal hospitals, accept for care only isolated fragments of the population. Furthermore, these departments are operated in such close conjunction with the parent institutions that it is frequently impossible to separate the revenues or expenditures of the two.

In the discussion which follows, each of the three medical types is, as stated earlier, treated separately; however, the general and allied special hospitals receive more extensive investigation than either the mental or tuberculosis. In the first place, popular interest tends to be focused on general hospitals chiefly because of the variety and spread of their service. Differences in the numbers of persons reached by hospitals of the three major medical types are illustrated by the fact that registered mental and tuberculosis institutions, although providing two-thirds of the patient days of care afforded by all hospitals, report less than 300,000 annual admissions, while registered general and special hospitals report approximately 9,000,000.[6] In the second place, diversity in operating agencies and consequently in sources of revenue distinguishes those offering general or closely related special services. Being largely of voluntary control, they are

[5] Special hospitals, as used here, are those furnishing types of care which are closely identified with general medical and surgical service. They include maternity, industrial, isolation, eye-ear-nose throat, orthopedic, children's, and others offering similar specialized types of care.

[6] See footnote 4.

supported in great measure by fees received directly from patients, whereas those affording care to mental and tuberculosis cases are maintained chiefly by governmental appropriations.

GENERAL AND ALLIED SPECIAL HOSPITALS

More than 400,000 beds distributed among some 4,500 registered hospitals represent the aggregate general and allied special facilities owned by non-Federal agencies. Of these beds, one-fourth are supported by State, county, or city governments, or by the last two in combination; almost two-thirds are controlled by nonprofit organizations such as churches, fraternal orders, and similar associations; and one-tenth are maintained by individuals or organized groups, often referred to as proprietary agencies, that are free to use as they see fit any profits which may be derived from their hospital investments.

The power of financial resources over the presence of hospital facilities within an area is clearly demonstrated in figure 1, which shows

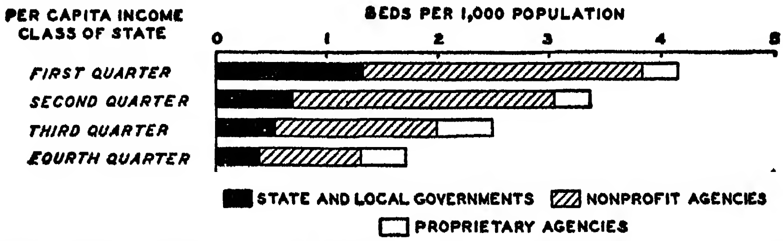

FIGURE 1.—Beds per 1,000 population in general and special hospitals of different control, by per capita income class of State

for the four income classes of States number of beds per 1,000 population according to the agency in control. From 4.16 beds per 1,000 persons in the first quarter of the States, the total drops to 1.72 in the last quarter, a decline that is especially striking inasmuch as recent surveys show disabling illnesses to be more prevalent among the poorer than the wealthier families.[7] In the main, distribution within separate control groups follows the pattern just described. Beds in hospitals managed by State and local governments and by nonprofit organizations are roughly three times more numerous in the highest quarter of the States than in the lowest. To this apportionment the facilities owned by proprietary agencies offer exception, for, on a population base, they are more common in the States with low incomes than in the relatively prosperous ones.

Among individual States, ratios of beds to population are, of course, wider in range. The District of Columbia and Massachusetts, with more than 5 beds per 1,000 persons, afford strong contrast with

[7] Britten, Rollo H., Collins, Selwyn D., and Fitzgerald, James S. The National Health Survey: Some general findings as to disease, accidents, and impairments in urban areas. Pub Health Rep., 55:444 (1940).

Arkansas and Mississippi which possess scarcely more than 1 bed for the same number of inhabitants. Nevertheless, considerable uniformity exists among the ratios applying to States within each income class. Probably the only notable exception is that Wyoming in the first class has a smaller share of beds, comparatively, than has North Dakota, which belongs to the last income group.

Since it has been demonstrated that the income of an area reflects the quantity of hospital facilities existing there, the question may well be asked as to what influence is exerted by income rate upon the amount of hospitalization for inhabitants of each economic area. In other words, how does the number of days of hospital care per unit of population in one area compare with corresponding figures for areas of different financial status? In answer to the question, figure 2 is submitted. The aggregate days of care in general and special hospitals represent the reported average daily census multi-

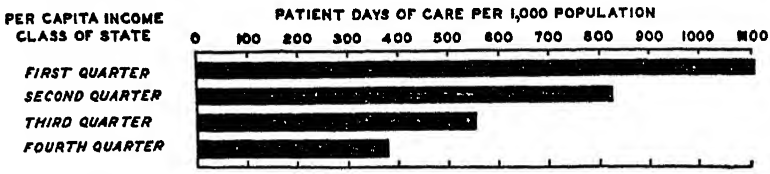

FIGURE 2.—Patient days of care per 1,000 population in general and special hospitals, by per capita income class of State

plied by 365. The resulting total is a slight understatement since a few hospitals containing approximately 2 percent of all beds failed to report data on the number of patients per day.

The weight of average income upon amount of hospitalization is closely equivalent to its weight upon provision of facilities. If money is available, evidently needs for hospital treatment are frequently met, for in States of the highest income group more than 1,100 days of care per 1,000 population are recorded for 1937. In States of the lowest income group, annual days of care for the same unit of population amount to only 377. Three members of the wealthiest class of States, District of Columbia, Massachusetts, and Rhode Island, actually exceed 1,300 days of care for every 1,000 persons; two members of the poorest class, Arkansas and Mississippi, barely exceed 200 days.

The sequence of the findings concerning the dominance of income over supply and use of hospital facilities is sustained by the percentages appearing in figure 3, which shows the proportion of beds occupied in each of the four areas established on an income basis. The percentage of occupancy, it may be explained, represents the ratio of the average daily census to the number of beds reported by the hospital. Despite the fact that one would expect beds in regions where bed-population ratios are low to be used more extensively than those located in regions

where these ratios are high, such is not the case—presumably because of the limitations imposed by the restricted incomes characterizing areas with meager facilities. In States of the highest income class, three-fourths of all general and special bed facilities are occupied; among those of the second quarter, hardly more than two-thirds are in use; and the last two quarters, almost equal in rate of occupancy, show even further reduction. Practically every State in the wealthiest class maintains an occupancy rate above the average for all non-Federal general and special hospitals, outstanding exceptions being Nevada and Wyoming. The figures for Rhode Island show a utilization rate slightly above 80, which closely approaches the figure usually considered optimum. Louisiana, one of the poorer States, ranks next to Rhode Island in point of utilization, an anomaly partially explained by the existence in Louisiana of a chain of State-supported hospitals. The two States ranking lowest in per capita income are the only ones

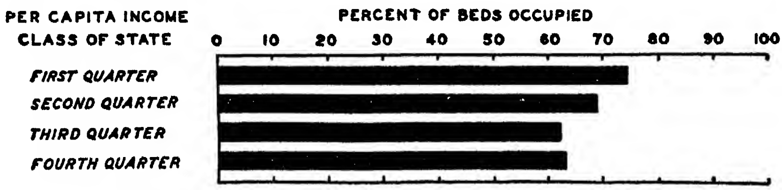

FIGURE 3.—Percentage of beds occupied in general and special hospitals, by per capita income class of State

reporting less than half of their beds to be occupied. Clearly, then, where money is scarcest beds are fewest, and where beds are fewest they are least often used.

Analysis of the total receipts of hospitals for current operating purposes and of the channels through which this revenue is obtained clarifies to some degree reasons for the low occupancy prevailing in many general and special hospitals. In succeeding pages frequent reference will be made to per capita payments to hospitals; these may be identified as the sums obtained when all hospital income, exclusive of gifts for permanent endowment, is divided by the total population of the area involved. Further, per capita payments are broken into three parts according to the source from which hospitals secure them. The first part includes all fees for regular and special services collected directly from patients; the second contains all tax funds, emergency or otherwise, appropriated by governments; and the third represents donations, interest, and miscellaneous income that may be used to meet operating expense.

The estimated average per capita payment by inhabitants of the United States toward the operation of general and special hospitals, exclusive of Federal, is $3.37. As may be noted in figure 4, striking reductions in the payments per capita to hospitals occur from the highest fourth of the States to the lowest. Residents of the richest

States pay annually more than $5 per person toward the operation of general and special hospitals; those of the next wealthiest class pay $3; those of the third group pay $2; and those living in the poorest States make a per capita outlay of less than $1.50. These averages for the several economic areas conceal extreme divergences among separate States, as illustrated by the fact that inhabitants of Massachusetts spend $7.05 for the upkeep of general and special hospitals while people in Mississippi pay out $0.67.

Components of the payments under discussion, that is, amounts received from patients, from taxes, and from miscellaneous sources, repeat the pattern established by the whole. If the payments by patients to hospitals located in States of the first income class are distributed over the entire population of these States, it is found that the average for residents thereof is nearly $3; in like manner, the average for those in States of the last income class is less than $1. Similar reductions occur in the per capita sums received by hospitals in the form of taxes or as so-called miscellaneous revenue. Singulari-

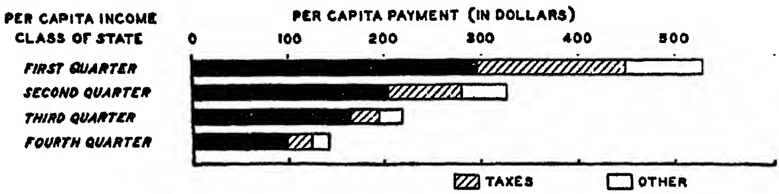

FIGURE 4.—Estimated annual per capita payment for care in general and special hospitals, by per capita income class of State

ties of certain States may be illustrated by citing such extremes as these: Residents of the District of Columbia, wealthiest of areas from point of income, make an annual per capita payment of $4.22 in the form of fees charged patients; and those in Arkansas, second poorest of the States, average $0.46 per person for such payments. Residents of California spend through the medium of taxes $2.15 per capita; for Alabama the corresponding figure is $0.01. Hospital income classed here as miscellaneous amounts to $2.07 per person in Rhode Island and to $0.01 in Mississippi.

Of greater interest than the absolute per capita payments is the proportion of each of these payments that is derived from a particular source. About 62 percent of the aggregate sum is expended in the form of fees collected from patients, 24 percent through taxes, and the remaining 14 percent by way of other channels. Such distribution places major responsibility for hospital maintenance upon individuals who are ill and who by virtue of the fact are likely to be less able to afford hospital service. If operation of hospitals is mainly dependent upon fees paid by patients, opportunities for treatment are limited not only among indigent persons but also among the marginal income

classes that are not on relief but are unable to purchase hospital care after essentials of life have been procured. As taxation becomes an important means of support, possibilities become greater that those of straitened circumstances, as well as their more prosperous neighbors, may obtain hospital care. As wealth decreases from one income class of States to another, the proportion of hospital income obtained directly from patients increases; concomitantly, the relative amounts from taxes and miscellaneous sources diminish. To the evenness of this trend the fourth quarter of the States offers slight interruption in that the percentage of revenue from patients does not continue the increase but drops to a smaller figure than that for the third quarter.

Although multiple schemes of hospital support prevail among the various States, there is noticeable congruity in the patterns formed by percentages designating specific sources of income for hospitals located in States composing the same economic group. Within no State except Wyoming do the hospitals located in States of the first per capita income class receive more than two-thirds of their income from patients; within the second, third, and fourth quarters, the maximum percentages from patients are 82, 87, and 94, respectively, for the ranking States taken as a whole. The two minimum figures are those for Louisiana and Rhode Island, which belong, in the order named, to the lowest and highest per capita income classes. In Rhode Island, as in a number of other New England States, a considerable fraction of the total hospital income represents earnings from endowments; in Louisiana, governmental appropriations account for almost half of the receipts. From the standpoint of sums derived from taxes, it may be added that hospitals in States of the first two quarters receive anywhere from 10 to 38 percent from public funds. Among the 24 States comprising the lower half, there are 8 in which hospitals secure less than 10 percent of their income from taxes.

Are the small sums paid to hospitals by inhabitants of poor States truly commensurate with their ability to pay? To determine whether average expenditures for hospital support are in keeping with average income, the hospital payments per person were converted into figures showing payments per $1,000 income within the States. For this purpose, State income reported for the single year 1935[8] was used, since hospital income data employed in this report cover that year. The resulting hypothetical amounts as shown in figure 5 prove that contributions toward hospital maintenance conform in great measure with the monetary resources of the area. It will be remembered that according to figure 4 per capita payments to hospitals are only one-fourth as large in the last quarter of the States as in the first. When expressed as payments per $1,000 income, the sum for the lowest income class of States is almost three-fourths of the sum for the

[8] See footnote 3.

highest income class. To be exact, residents of the more impoverished States contribute from every $1,000 of income $6.06 toward hospital upkeep, and those residing in the more prosperous States contribute, correspondingly, $8.42.

Extraordinary differences among States or financially related classes of States are likewise found to be largely effaced when the total payments per $1,000 income are divided according to the sources from which hospitals secure the funds. Reference to figure 5 reveals the narrow range of the new ratios. Amounts from patients are remarkably uniform for each of the per capita income classes of States, and, as may be seen in table 5, are not widely dissimilar among particular States constituting the four classes. Although more divergent than the sums paid by patients, amounts originating from taxes and miscellaneous sources are not notably disparate. These last-mentioned amounts tend, however, to be less in the half of the States with lowest per capita incomes than in the other half. The somewhat larger

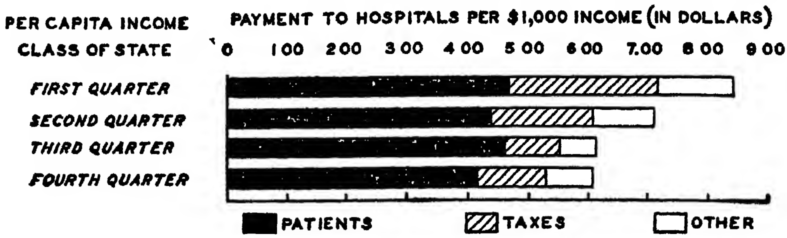

FIGURE 5.—Estimated annual payment per $1,000 income within State for care in general and special hospitals, by per capita income class of State

payments per $1,000 income to hospitals in States of the upper half do not, then, reflect greater direct expenditures by patients but rather indirect outlays in such forms as bequests and governmental appropriations that are considerably larger than corresponding allotments in States of the lower half. In reality, persons in the poorer States are, according to financial ability, devoting more toward hospitalization purposes than are inhabitants of the richer States, inasmuch as the former must spend a greater share of their income for absolute necessities, thereby leaving proportionately less for such matters as hospital service.

MENTAL HOSPITALS

It is a matter of interest that for the United States as a whole the number of beds in the group of mental hospitals is greater than the number in all general and allied special hospitals. Almost 533,000 beds, slightly more than 4 for every 1,000 persons, are contained in 558 non-Federal mental hospitals throughout the country. In only 7 of the individual States is there a preponderance of beds in general and special hospitals over those in mental institutions. As is evident

in figure 6, most of the facilities for care of mental cases are supported by State and local governments. Actually, mental hospitals so controlled contain 96 percent of the total non-Federal bed facilities. Almost 4 beds per 1,000 persons are provided by mental hospitals under the management of State, county, and city governments, whereas less than 0.2 of a bed per 1,000 is maintained by nongovernmental or voluntary agencies. Every State is supplied with at least one mental hospital of governmental control; on the other hand, there are roughly a dozen which contain no mental institution of voluntary sponsorship. It may be added that care of persons with mental disorders appears to be largely a function of State governments, for the governmental group under discussion is composed chiefly of State-owned facilities. In Wisconsin only is there extensive operation of mental hospitals by county governments; control by city governments is rare in all areas.

The close relationship between economic status, as reflected by income rates, and supply of facilities is again emphasized in the sev-

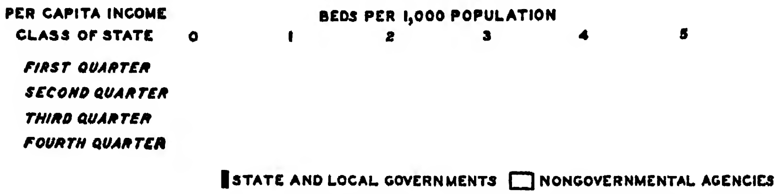

FIGURE 6.—Beds per 1,000 population in mental hospitals of different control, by per capita income class of State.

eral ratios giving beds in mental hospitals per unit of population. In both the voluntary and nonvoluntary control groups, facilities for hospitalizing mental cases are far more abundant in wealthy States than in poor ones. More than twice as many beds per unit of population are provided by governmental agencies in States of the first per capita income class as are supplied by similar agencies in States of the fourth income class. Instances of particular States magnify the dominance of wealth over the supply of existing facilities. Two of the 8 richest States are supplied with more than 6 beds per 1,000 persons. One State of the poorest group falls below 2 beds for the same number of inhabitants. The scarcity of total beds for mental patients, 0.9 per 1,000 population, as recorded for the District of Columbia is readily explained by the fact that the major part of the facilities found there are in hospitals under Federal supervision, which are excluded from this study.

That mental institutions, most of which are usually tax-supported, are occupied to full capacity is apparent in figure 7. Other information not of formal survey character shows that many hospitals are

filled beyond their rated capacity. Although practically complete utilization is indicated for hospitals in States composing each of the per capita income classes, yet even in the exceptionally high occupancy figures there is discernible slight evidence of the influence exerted by financial resources upon the sum total of hospital use. Where income per person is most restricted, the rate of occupancy is a trifle below the average for the country. Among individual States,

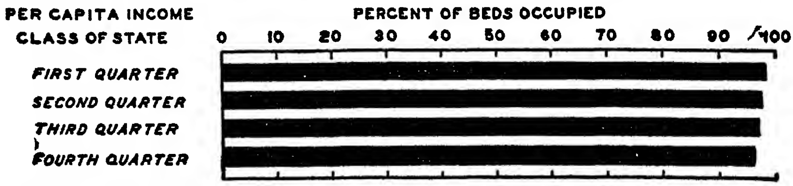

FIGURE 7.—Percentage of beds occupied in mental hospitals, by per capita income class of State.

percentages are consistently high, only two, Nevada and North Dakota, dropping below 90.

The sums required to operate mental hospitals are decidedly smaller than those necessary for the upkeep of general and special institutions. Reduced though they are, the amounts still reflect the power of varying financial capacities upon the payments to hospitals in localities of different economic status. The pattern of figure 8 showing the range of individual payments to mental hospitals almost reproduces that of figure 4 which describes the general and special group, except that the amounts are at a lower level. Inhabitants of States with per capita incomes of less than $335 (the lowest quarter) pay for hospitalization

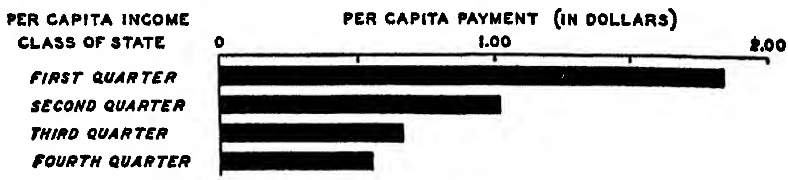

FIGURE 8—Estimated annual per capita payment for care in mental hospitals, by per capita income class of State.

in mental institutions an average of only $0.55. Persons in States with incomes of nearly $600 or more (the highest quarter) spend $1.83 for the same purpose.

In the appendix it will be observed that financial figures for certain States are withheld from the tables to avoid disclosure of confidential information. This course is followed when the number of hospitals of particular type in the State is so small that data reported by individual institutions might be revealed. Massachusetts and North Carolina, which are unlike economically, occupy extreme positions when States are ranked according to per capita payments to hospitals, residents of

the former averaging $3 each, those of the latter $0.25. Hence, as in the case of the general and special group, the measure of support afforded mental hospitals is determined in general by the average income of the area involved.

TUBERCULOSIS HOSPITALS

Tuberculosis hospitals, almost as numerous as the mental, contain roughly 70,000 beds or a little more than one-half of a bed per 1,000 population. Distribution of tuberculosis hospitals according to ownership resembles in the main that of mental institutions. State and local governments are not, however, so completely dominant in the control of tuberculosis sanatoria as they are in the control of mental hospitals. Nor are States the principal operating agencies; county governments have assumed major responsibility for main-

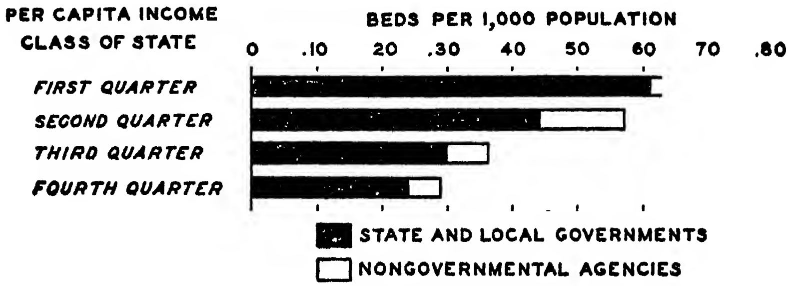

FIGURE 9.—Beds per 1,000 population in tuberculosis hospitals of different control, by per capita income class of State.

tenance of facilities to be used in combating tuberculosis. Figure 9 illustrates the sparseness of bed facilities where income is lowest. Regardless of whether hospitals are sponsored by governmental or voluntary agencies, the pattern of bed distribution is the same—a larger proportion in regions with sufficient means to provide and maintain them, and decreased proportions as the income ranges grade downward.

Though knowledge of the ratios of hospital beds to population is of some value in planning tuberculosis control programs, it is rather generally conceded that the most satisfactory measure of need for facilities is not total population but prevalence of tuberculosis as indicated by the number of deaths from the disease. Such being the case, figure 10 was prepared to show the number of beds per annual death from tuberculosis [9] in the four previously established economic areas of the country. The totals presented in this figure cover all beds for tuberculosis which are contained in tuberculosis sanatoria and preventoria and in general and isolation hospitals,[10] except those

[9] Vital Statistics—Special Reports, vol 7, No 26, March 23, 1939. Bureau of the Census, Department of Commerce.

[10] Tuberculosis Hospital and Sanatorium Directory, 1938. National Tuberculosis Association.

of Federal control. The presence in mental hospitals of a few thousand beds devoted to care of tuberculous inmates leads to a slight understatement of the bed-death ratios, since these beds are excluded from the aggregate facilities while deaths from tuberculosis occurring in such institutions are contained in the mortality reports employed in the analysis. The resulting discrepancy is not, however, believed to be sufficient to reduce the value of the comparisons which are made.

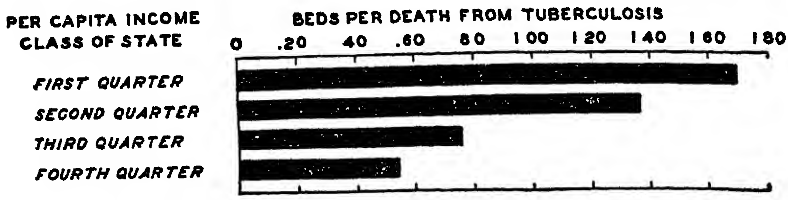

FIGURE 10.—Beds in tuberculosis hospitals and in tuberculosis departments of general hospitals per death from tuberculosis (all forms), by per capita income class of State

Figure 10 confirms in cogent manner the findings of figure 9, which establish the ascendant position of per capita income in regulating the distribution of facilities. Beds for care of tuberculosis are not apportioned according to needs as manifested by frequency of deaths from the disease but chiefly according to the purchasing power of the particular area. A decrease from 1.68 to 0.54 beds per death from tuberculosis occurs between the average for the first quarter of the States and for the fourth quarter. Certain States fail, of course, to

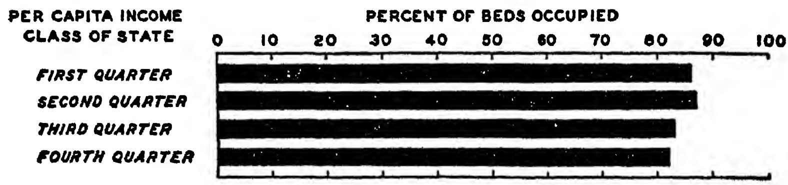

FIGURE 11.—Percentage of beds occupied in tuberculosis hospitals, by per capita income class of State.

comply with the pattern established by those of similar economic rank. For example, Nevada, Wyoming, Montana, and Arizona have fewer beds per death than have other States of like per capita income standing; on the contrary, Iowa and North Dakota have considerably more than have the States closely resembling them in economic capacity.

Since tuberculosis hospitals, like mental hospitals, depend principally upon taxes for support, their admissions are not limited to those who possess means with which to pay for services. Consequently their occupancy rates, not rigidly governed by the economic status of the localities served, tend to run high in all parts of the country, as is indicated in figure 11. The percentages for each of the income classes do reveal, nevertheless, that there is a small difference in the

utilization rates for the upper and the lower half of the States, the presence of wealth being conducive to more complete occupancy.

The influence of per capita income on the payments per person to tuberculosis sanatoria is even more pronounced than it is in the instance of mental or of general and special hospitals. Reference to figure 12 shows that the average sum paid by those dwelling in States of the uppermost group is four times as great as that paid by dwellers in States of the lowest economic group. When States are considered singly, Colorado, with an average of $1.32, stands foremost in per capita payments to tuberculosis hospitals. Since the State contains no tax-supported sanatoria and since many charitable and fraternal orders in different sections of the country have established tuberculosis hospitals there, support of these institutions can be only in small

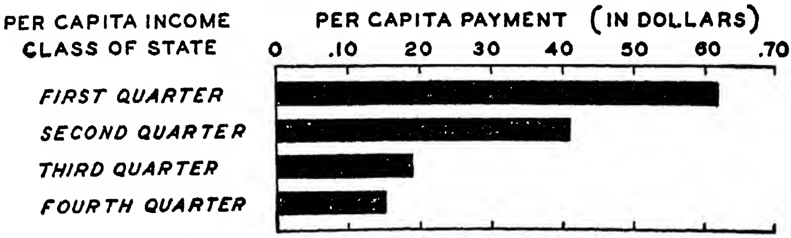

FIGURE 12.—Estimated annual per capita payment for care in tuberculosis hospitals, by per capita income class of State

measure a responsibility of residents of the State. In two other States of the more affluent half, Connecticut and Massachusetts, persons pay more than $1 each for support of tuberculosis sanatoria; in a few States of the less affluent half, expenditures for the same objective are around $0.05.

SUMMARY

A digest of the findings accumulated from the foregoing investigations may serve to emphasize the salient point developed by the various analyses: Presence of hospital facilities and utilization of these facilities, as well as the sums paid for their maintenance, are to a striking degree dependent upon the purchasing power of an area. After States had been grouped into four economic classes according to descending order of average per capita income for the 3-year period ending in 1937, hospital facilities located in each class were projected against the economic background thus provided. It was found that regardless of the medical type of the hospitals or, as a rule, of their operating agency, the number of beds per unit of population is roughly proportionate to the financial means of the area. Bed facilities in general and allied special hospitals are almost two and a half times as numerous in the wealthy States constituting the first quarter as in the poor ones of the fourth quarter. Practically the same coordination

between amount of income and quantity of facilities obtains in the distribution of beds for mental and tuberculosis cases.

The effect of varying income rates is even more far-reaching. A person's chances to receive hospital care, as well as the opportunity which hospitals, especially those dependent upon fees from patients, have to operate at optimum capacity, are contingent upon the economic status of the area. Despite the fact that illness is more commonly an adjunct of poverty than of wealth, it is in the poorest States that the fewest patient days per unit of population are reported for general and special hospitals. Although no tabular material showing amount of hospitalization has been given here for mental and tuberculosis hospitals, it is known that proportionate days of care within them are also affected strongly by income rates for a designated region.

Not only on the days of hospital care received per population unit is per capita income influential but also on the proportion of beds occupied in a given group of hospitals. Inasmuch as most mental and tuberculosis hospitals are largely supported by taxation, they are not compelled as are many of the general and special hospitals to demand direct payments from patients; hence they are often used to capacity and sometimes even beyond the level which assures efficiency of operation. Yet they reveal in small measure what the general and special hospitals reveal to a marked extent—that the finances of an area determine the degree to which beds in existing hospitals are used. In brief, the situation is that few facilities, limited amounts of hospitalization, and low occupancy are coexistent in areas with meager per capita incomes; in areas of increasingly high economic status, supply of facilities and extent of their use are on the whole roughly proportionate to the enlarged average income.

Payments per individual toward hospital operation show striking deviation from one income class of States to another, sometimes being four times as great in States of the first class as in those of the last class. This interrelationship between payments to hospitals and per capita income prevails among institutions of all medical types. The foremost question which follows examination of the actual sums paid to hospitals is whether or not persons are sharing according to their ability the burden of hospital maintenance. Conversion of per capita payments into payments per $1,000 income established the fact that throughout the several areas total outlays as based on income are remarkably consistent. Of particular import is the uniformity, on this basis, of the amounts supplied directly by patients. Thus it appears that for the support of hospital facilities persons everywhere are paying according to their means, but that from region to region their achievements are widely different as a result of divergent financial capacities.

Appendix

Table 1.—*Beds per 1,000 population in general and special hospitals* [1] *of different control, by States arrayed in descending order of average per capita income 1935–37* [2]

State	Population (add 000)[3]	Total beds [4]	Beds per 1,000 population in hospitals of specified control: All hospitals	State and local governments	Nonprofit agencies	Proprietary agencies
United States	129,257	405,846	3.14	0.83	1.96	0.35
First quarter	45,915	190,922	4.16	1.34	2.53	.29
District of Columbia	637	3,348	5.34	1.78	3.50	.06
Delaware	261	809	3.10	.33	2.71	.06
New York	12,959	59,344	4.58	1.35	2.90	.33
Nevada	101	427	4.23	2.70	1.18	.35
California	6,154	27,187	4.42	2.14	1.74	.54
Connecticut	1,741	6,304	3.62	.34	3.22	.06
Rhode Island	681	3,026	4.44	1.48	2.91	.05
Massachusetts	4,426	23,137	5.23	2.01	2.89	.33
Michigan	4,830	17,115	3.54	1.47	1.86	.21
Maryland	1,679	6,871	4.09	1.17	2.72	.20
Illinois	7,878	27,832	3.53	.77	2.52	.24
New Jersey	4,343	14,849	3.42	.79	2.51	.12
Wyoming	235	673	2.86	1.65	.55	.66
Second quarter	32,034	107,707	3.36	.69	2.38	.29
Montana	539	2,687	4.98	.55	3.67	.76
Ohio	6,733	19,094	2.84	.70	2.04	.10
Washington	1,658	6,240	3.76	.65	2.61	.47
Pennsylvania	10,176	35,416	3.48	.64	2.73	.11
Oregon	1,027	3,763	3.66	.47	2.27	.92
Wisconsin	2,926	10,915	3.73	.85	2.61	.27
Colorado	1,071	4,639	4.33	.93	2.98	.42
Arizona	412	1,487	3.61	.66	2.57	.38
Minnesota	2,652	10,942	4.13	1.07	2.22	.84
New Hampshire	510	2,049	4.02	.73	2.74	.55
Maine	856	2,724	3.18	.26	2.08	.84
Indiana	3,474	7,751	2.23	.60	1.43	.20
Third quarter	23,909	60,183	2.51	.53	1.50	.48
Florida	1,670	4,539	2.72	1.08	1.23	.41
Utah	519	1,763	3.40	.70	2.29	.41
Idaho	493	1,400	2.84	.38	1.58	.88
Missouri	3,989	11,004	2.78	.70	1.85	.23
Vermont	383	1,149	3.00	----------	2.08	.32
Nebraska	1,364	4,350	3.19	.67	1.92	.60
Iowa	2,552	6,966	2.73	.55	1.92	.26
Kansas	1,864	4,851	2.60	.38	2.02	.20
New Mexico	422	1,361	3.23	.48	2.33	.42
West Virginia	1,865	4,955	2.66	.26	1.26	1.14
Texas	6,172	12,232	1.98	.45	.94	.59
Virginia	2,706	5,523	2.04	.39	1.17	.48
Fourth quarter	27,309	47,034	1.72	.40	.93	.39
Louisiana	2,132	5,608	2.63	1.27	.96	.40
South Dakota	692	1,823	2.63	.11	2.05	.47
Oklahoma	2,548	4,240	1.67	.32	.52	.83
North Dakota	706	2,144	3.04	.09	2.77	.18
Tennessee	2,893	4,831	1.67	.49	.88	.30
Kentucky	2,920	4,931	1.69	.34	1.08	.27
Georgia	3,085	4,783	1.55	.54	.55	.46
North Carolina	3,492	6,500	1.86	.21	1.41	.24
South Carolina	1,875	3,002	1.60	.50	.95	.15
Alabama	2,895	4,028	1.39	.28	.64	.47
Arkansas	2,048	2,590	1.26	.17	.76	.33
Mississippi	2,023	2,548	1.26	.22	.55	.49

[1] Special hospitals, as used here, are hospitals furnishing types of care which are closely identified with general medical and surgical service. These hospitals include maternity, industrial, isolation, eye-ear-nose-throat, orthopedic, children's, and others offering similar specialized types of care. Mental and tuberculosis hospitals are given separate classification.

[2] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[3] Population, as of July 1, 1937, estimated by the Bureau of the Census, Department of Commerce.

[4] Bed totals represent tabulations of data for individual hospitals published in the Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938. Data for all institutional hospitals and for other hospitals operated by Federal agencies are excluded.

TABLE 2.—*Patient days of care per 1,000 population in general and special hospitals,*[1] *by States arrayed in descending order of average per capita income 1935–37* [2]

State	Population (add 000) [3]	Total patient days of care [4]	Patient days of care per 1,000 population
United States	129,257	100,825,775	780.0
First quarter	45,915	50,908,010	1,108.7
District of Columbia	627	853,370	1,361.0
Delaware	261	206,225	790.1
New York	12,959	16,666,995	1,286.1
Nevada	101	93,440	925.1
California	6,154	7,219,335	1,173.1
Connecticut	1,741	1,672,430	960.6
Rhode Island	681	885,855	1,300.8
Massachusetts	4,426	5,934,535	1,340.8
Michigan	4,830	4,774,565	988.5
Maryland	1,679	1,857,485	1,106.3
Illinois	7,878	6,815,280	865.1
New Jersey	4,343	3,795,635	874.0
Wyoming	235	132,860	565.4
Second quarter	32,034	26,406,655	824.3
Montana	539	575,240	1,067.2
Ohio	6,733	4,953,780	735.7
Washington	1,658	1,443,210	870.5
Pennsylvania	10,176	8,993,600	883.8
Oregon	1,027	940,605	915.9
Wisconsin	2,926	2,511,565	858.4
Colorado	1,071	1,043,900	974.7
Arizona	412	320,470	777.8
Minnesota	2,652	2,635,300	993.7
New Hampshire	510	483,260	947.6
Maine	856	653,715	763.7
Indiana	3,474	1,852,010	533.1
Third quarter	23,999	13,217,015	550.7
Florida	1,670	859,910	514.9
Utah	519	417,560	804.5
Idaho	493	284,335	576.7
Missouri	8,989	2,726,185	683.4
Vermont	383	281,415	734.8
Nebraska	1,364	980,025	718.5
Iowa	2,552	1,526,795	598.3
Kansas	1,864	1,063,610	570.6
New Mexico	422	233,965	554.4
West Virginia	1,865	1,057,040	566.8
Texas	6,172	2,434,915	394.5
Virginia	2,706	1,351,230	499.3
Fourth quarter	27,309	10,294,095	376.9
Louisiana	2,132	1,545,775	725.0
South Dakota	692	335,070	484.2
Oklahoma	2,548	767,960	301.4
North Dakota	706	463,185	656.1
Tennessee	2,893	1,118,300	386.6
Kentucky	2,920	1,008,720	366.0
Georgia	3,085	1,059,505	343.5
North Carolina	3,492	1,518,705	434.9
South Carolina	1,875	741,315	395.4
Alabama	2,895	825,995	285.3
Arkansas	2,048	425,225	207.6
Mississippi	2,023	424,130	209.7

[1] Special hospitals, as used here, are hospitals furnishing types of care which are closely identified with general medical and surgical service. These hospitals include maternity, industrial, isolation, eye-ear-nose-throat, orthopedic, children's, and others offering similar specialized types of care. Mental and tuberculosis hospitals are given separate classification.

[2] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[3] Population, as of July 1, 1937, estimated by the Bureau of the Census, Department of Commerce.

[4] Total patient days of care represent tabulations of data for individual hospitals published in the Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938. Data for all institutional hospitals and for other hospitals operated by Federal agencies are excluded. To compute total days of care, the average daily census was multiplied by 365. This figure represents a slight understatement inasmuch as a few hospitals containing approximately 2 percent of all beds failed to report their average daily census.

TABLE 3.—*Percentage of beds occupied in general and special hospitals,[1] by States arrayed in descending order of average per capita income 1935–37*[2]

State	Total beds[3]	Average daily census	Percent of beds occupied	State	Total beds[3]	Average daily census	Percent of beds occupied
United States	306, 239	276, 235	60. 7	Third quarter	58, 448	36, 211	62. 0
				Florida	4, 311	2, 358	51. 7
First quarter	187, 690	130, 474	74. 3	Utah	1, 735	1, 144	65. 9
District of Columbia	3, 096	2, 338	75. 5	Idaho	1, 304	779	59. 7
Delaware	809	565	60. 8	Missouri	11, 013	7, 469	67. 8
New York	58, 378	45, 663	78. 2	Vermont	1, 149	771	67. 1
Nevada	427	256	60. 0	Nebraska	4, 305	2, 685	62. 4
California	20, 628	10, 779	74. 3	Iowa	6, 850	4, 183	61. 1
Connecticut	6, 173	4, 582	74. 2	Kansas	4, 790	2, 914	60. 8
Rhode Island	3, 026	2, 427	80. 2	New Mexico	1, 236	641	51. 9
Massachusetts	22, 412	16, 259	72. 5	West Virginia	4, 765	2, 898	60. 8
Michigan	16, 924	13, 081	77. 3	Texas	11, 610	6, 671	57. 5
Maryland	6, 787	5, 080	75. 0	Virginia	5, 380	3, 702	68. 8
Illinois	27, 552	18, 672	67. 8				
New Jersey	14, 805	10, 399	70. 2	Fourth quarter	44, 730	28, 203	63. 0
Wyoming	673	364	54. 1	Louisiana	5, 348	4, 235	79. 2
				South Dakota	1, 628	918	56. 4
Second quarter	105, 362	72, 347	68. 7	Oklahoma	3, 951	2, 104	53. 3
Montana	2, 613	1, 576	60. 3	North Dakota	2, 091	1, 269	60. 7
Ohio	18, 735	13, 572	72. 4	Tennessee	4, 578	3, 064	66. 9
Washington	5, 960	3, 954	66. 3	Kentucky	4, 763	2, 928	61. 5
Pennsylvania	34, 919	24, 640	70. 6	Georgia	4, 414	2, 903	65. 8
Oregon	3, 548	2, 577	72. 6	North Carolina	6, 205	4, 161	67. 1
Wisconsin	10, 851	6, 881	63. 4	South Carolina	2, 917	2, 031	69. 6
Colorado	4, 483	2, 860	63. 8	Alabama	3, 950	2, 263	57. 3
Arizona	1, 409	878	62. 3	Arkansas	2, 565	1, 165	45. 4
Minnesota	10, 715	7, 220	67. 4	Mississippi	2, 320	1, 162	49. 9
New Hampshire	1, 910	1, 324	69. 3				
Maine	2, 571	1, 791	69. 7				
Indiana	7, 648	5, 074	66. 3				

[1] Special hospitals, as used here, are hospitals furnishing types of care which are closely identified with general medical and surgical service. These hospitals include maternity, industrial, isolation, eye-ear-nose-throat, orthopedic, children's, and others offering similar specialized types of care. Mental and tuberculosis hospitals are given separate classification.

[2] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[3] Bed totals represent tabulations of data for individual hospitals published in the Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938. Data for all institutional hospitals and for other hospitals operated by Federal agencies are excluded. Only beds in hospitals that reported satisfactory information regarding average daily census are employed here.

TABLE 4.—*Estimated annual per capita payment for care in general and special hospitals,*[1] *by States arrayed in descending order of average per capita income 1935–37* [2]

State	Population (add 000) [3]	Per capita payment to hospitals [4] from specified source			
		All sources	Patients	Taxes	Other
United States	127,521	$3.37	$2.08	$0.82	$0.47
First quarter	45,346	5.27	2.94	1.54	.79
District of Columbia	594	6.38	4.22	1.25	.91
Delaware	256	3.57	2.02	.91	.64
New York	12,890	6.53	3.28	2.10	1.15
Nevada	99	7.04	3.81	1.49	1.74
California	5,907	5.67	3.08	2.15	.44
Connecticut	1,717	4.51	3.02	.61	.88
Rhode Island	681	5.70	2.77	.86	2.07
Massachusetts	4,375	7.05	3.94	1.50	1.61
Michigan	4,731	4.72	3.08	1.38	.26
Maryland	1,669	3.76	2.06	.96	.74
Illinois	7,817	3.20	2.16	.72	.32
New Jersey	4,288	4.33	2.20	1.58	.55
Wyoming	232	2.81	2.03	.58	.20
Second quarter	31,725	3.25	2.02	.77	.46
Montana	531	3.64	2.99	.36	.29
Ohio	6,707	3.30	2.04	.73	.53
Washington	1,633	3.34	2.47	.65	.22
Pennsylvania	10,007	3.07	1.56	.87	.64
Oregon	1,008	3.02	2.46	.47	.09
Wisconsin	2,908	3.68	2.39	1.04	.25
Colorado	1,062	4.49	2.62	.97	.90
Arizona	406	3.03	1.88	.65	.50
Minnesota	2,627	4.16	2.78	1.04	.34
New Hampshire	502	3.87	2.82	.38	.07
Maine	845	3.10	2.29	.31	.50
Indiana	3,429	2.20	1.60	.45	.15
Third quarter	23,626	2.15	1.62	.31	.22
Florida	1,614	2.37	1.55	.62	.20
Utah	515	3.05	2.39	.56	.10
Idaho	479	2.31	1.96	.32	.03
Missouri	3,913	2.75	1.93	.15	.67
Vermont	377	2.56	1.96	.08	.52
Nebraska	1,364	2.36	1.89	.37	.10
Iowa	2,534	2.38	1.67	.57	.14
Kansas	1,878	2.14	1.68	.39	.07
New Mexico	422	1.75	1.29	.03	.43
West Virginia	1,816	2.16	1.87	.09	.20
Texas	6,077	1.65	1.28	.27	.10
Virginia	2,637	1.73	1.37	.25	.11
Fourth quarter	26,824	1.40	.96	.27	.17
Louisiana	2,120	1.99	.92	.97	.10
South Dakota	692	1.87	1.55	.15	.17
Oklahoma	2,509	1.36	1.27	.06	.03
North Dakota	700	1.98	1.65	.30	.03
Tennessee	2,824	1.70	1.11	.30	.29
Kentucky	2,846	1.42	.91	.34	.17
Georgia	3,035	1.64	1.04	.48	.12
North Carolina	3,417	1.55	1.06	.15	.34
South Carolina	1,810	1.17	.69	.17	.31
Alabama	2,834	1.08	.99	.01	.08
Arkansas	1,909	.74	.46	.09	.19
Mississippi	2,008	.67	.49	.17	.01

[1] Special hospitals, as used here, are hospitals furnishing types of care which are closely identified with general medical and surgical service. These hospitals include maternity, industrial, isolation, eye-ear-nose-throat, orthopedic, children's, and others offering similar specialized types of care. Mental and tuberculosis hospitals are given separate classification.

[2] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[3] Population, as of July 1, 1935, estimated by the Bureau of the Census, Department of Commerce.

[4] Pennell, Elliott H., Mountin, Joseph W., and Pearson, Kay: Business Census of Hospitals, 1935, General Report. Supplement 154 to the Public Health Reports. U. S. Government Printing Office, 1939

TABLE 5.—*Estimated annual payment per $1,000 income within State for care in general and special hospitals,*[1] *by States arrayed in descending order of average per capita income 1935–37* [2]

State	Total income within State[3] 1935 (add 000,000)	Payment to hospitals[4] per $1,000 income within State from specified source			
		All sources	Patients	Taxes	Other
United States	$57,308	$7.49	$4.63	$1.82	$1.04
First quarter	28,387	8.42	4.70	2.47	1.25
District of Columbia	625	6.06	4.01	1.19	.86
Delaware	191	4.78	2.71	1.21	.86
New York	9,647	8.73	4.39	2.80	1.54
Nevada	69	10.06	5.45	2.12	2.49
California	8,993	8.51	4.63	3.22	.66
Connecticut	1,081	7.17	4.80	.97	1.40
Rhode Island	418	9.30	4.52	1.40	3.38
Massachusetts	2,639	11.09	6.53	2.48	2.08
Michigan	2,412	9.25	6.04	2.70	.51
Maryland	853	7.11	3.90	1.82	1.30
Illinois	4,024	6.21	4.19	1.40	.62
New Jersey	2,283	8.14	4.14	2.07	1.03
Wyoming	122	5.36	3.88	1.10	.38
Second quarter	14,530	7.10	4.41	1.68	1.01
Montana	270	7.01	5.77	.69	.55
Ohio	8,208	6.78	4.20	1.50	1.08
Washington	777	7.02	5.20	1.36	.46
Pennsylvania	4,709	6.44	3.27	1.83	1.34
Oregon	451	6.76	5.51	1.04	.21
Wisconsin	1,312	8.16	5.30	2.30	.56
Colorado	472	10.09	5.88	2.18	2.03
Arizona	177	6.93	4.30	1.47	1.16
Minnesota	1,112	9.83	6.57	2.47	.79
New Hampshire	228	8.52	6.20	.84	1.48
Maine	368	7.11	5.23	.73	1.15
Indiana	1,290	5.85	4.24	1.21	.40
Third quarter	8,252	6.16	4.64	.88	.64
Florida	616	6.20	4.06	1.62	.52
Utah	197	7.98	6.26	1.48	.24
Idaho	170	6.16	5.24	.85	.07
Missouri	1,535	7.02	4.93	.39	1.70
Vermont	146	6.60	5.04	.21	1.35
Nebraska	493	6.52	5.24	1.01	.27
Iowa	921	6.56	4.61	1.57	.38
Kansas	668	6.01	4.71	1.09	.21
New Mexico	141	5.22	3.84	.10	1.28
West Virginia	600	6.55	5.67	.29	.59
Texas	1,958	5.12	3.96	.84	.32
Virginia	798	5.71	4.52	.82	.37
Fourth quarter	6,199	6.06	4.18	1.16	.72
Louisiana	628	6.77	3.13	3.30	.34
South Dakota	188	6.90	5.73	.54	.63
Oklahoma	661	5.15	4.82	.22	.11
North Dakota	178	7.80	6.48	1.21	.11
Tennessee	693	6.94	4.53	1.22	1.19
Kentucky	685	5.89	3.76	1.43	.70
Georgia	741	6.72	4.25	1.97	.50
North Carolina	812	6.51	4.45	.63	1.43
South Carolina	391	5.49	3.26	.78	1.45
Alabama	539	5.08	5.21	.06	.41
Arkansas	357	4.16	2.59	.48	1.09
Mississippi	331	4.06	2.98	1.02	.06

[1] Special hospitals, as used here, are hospitals furnishing types of care which are closely identified with general medical and surgical service. These hospitals include maternity, industrial, isolation, eye-ear-nose-throat, orthopedic, children's, and others offering similar specialized types of care. Mental and tuberculosis hospitals are given separate classification.

[2] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[3] Nathan, Robert R., and Martin, John L.: State Income Payments, 1929-37. Bureau of Foreign and Domestic Commerce, Department of Commerce.

[4] Pennell, Elliott H., Mountin, Joseph W., and Pearson, Kay: Business Census of Hospitals, 1935, General Report. Supplement 154 to the Public Health Reports. U. S. Government Printing Office, 1939.

TABLE 6.—*Beds per 1,000 population in mental hospitals of different control, by States arrayed in descending order of average per capita income 1935–37* [1]

State	Population (add 000) [2]	Total beds [3]	Beds per 1,000 population in hospitals of specified control		
			All hospitals	State and local governments	Nongovernmental agencies
United States	129,257	532,627	4.12	3.97	0.15
First quarter	45,915	250,165	5.45	5.24	.21
District of Columbia	627	569	.91	.87	.04
Delaware	261	1,557	5.96	5.96	----------
New York	12,959	89,080	6.87	6.65	.22
Nevada	101	332	3.29	3.29	----------
California	6,154	28,859	4.69	4.48	.21
Connecticut	1,741	9,438	5.42	4.91	.51
Rhode Island	681	3,409	5.01	4.68	.33
Massachusetts	4,426	28,315	6.40	6.26	.14
Michigan	4,830	20,802	4.31	4.17	.14
Maryland	1,679	8,431	5.02	4.32	.70
Illinois	7,878	36,349	4.61	4.52	.09
New Jersey	4,343	22,110	5.09	4.84	.25
Wyoming	235	914	3.89	3.89	----------
Second quarter	32,034	135,852	4.24	4.05	.19
Montana	539	1,900	3.53	3.53	----------
Ohio	6,733	27,196	4.04	3.88	.16
Washington	1,658	7,589	4.58	4.53	.05
Pennsylvania	10,176	40,946	4.03	3.70	.33
Oregon	1,027	4,950	4.82	4.81	.01
Wisconsin	2,926	15,885	5.43	5.13	.30
Colorado	1,071	4,740	4.42	4.10	.32
Arizona	412	900	2.19	2.19	----------
Minnesota	2,652	13,448	5.07	5.03	.04
New Hampshire	510	2,641	5.18	5.18	----------
Maine	856	3,670	4.29	4.23	.06
Indiana	3,474	11,987	3.45	3.41	.04
Third quarter	23,999	76,786	3.20	3.07	.13
Florida	1,670	4,869	2.92	2.84	.08
Utah	519	1,392	2.68	2.68	----------
Idaho	493	1,460	2.96	2.96	----------
Missouri	3,989	14,074	3.53	3.34	.19
Vermont	383	2,160	5.64	3.49	2.15
Nebraska	1,364	5,324	3.90	3.80	.10
Iowa	2,552	10,573	4.15	3.94	.21
Kansas	1,864	6,912	3.71	3.66	.05
New Mexico	422	856	2.03	2.03	----------
West Virginia	1,865	3,964	2.12	2.12	----------
Texas	6,172	14,807	2.41	2.37	.04
Virginia	2,706	10,335	3.82	3.70	.12
Fourth quarter	27,309	69,824	2.56	2.51	.05
Louisiana	2,132	7,374	3.46	3.30	.16
South Dakota	692	2,390	3.45	3.45	----------
Oklahoma	2,548	8,262	3.24	3.21	.03
North Dakota	706	3,074	4.35	4.35	----------
Tennessee	2,893	7,020	2.43	2.37	.06
Kentucky	2,920	7,015	2.41	2.36	.05
Georgia	3,085	7,614	2.48	2.41	.07
North Carolina	3,492	7,600	2.18	2.08	.10
South Carolina	1,875	4,846	2.58	2.56	.02
Alabama	2,895	6,064	2.09	2.07	.02
Arkansas	2,048	4,021	1.96	1.96	----------
Mississippi	2,023	4,484	2.22	2.20	.02

[1] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.
[2] Population, as of July 1, 1937, estimated by the Bureau of the Census, Department of Commerce.
[3] Bed totals represent tabulations of data for individual hospitals published in the Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938. Data for all hospitals operated by Federal agencies are excluded.

TABLE 7.—*Percentage of beds occupied in mental hospitals, by States arrayed in descending order of average per capita income 1935–37* [1]

State	Total beds [2]	Average daily census	Percent of beds occupied
United States	520, 918	514, 823	97.2
First quarter	240, 845	214, 439	97.8
District of Columbia	569	557	97.9
Delaware	1, 557	1, 483	95.2
New York	89, 080	87, 111	97.8
Nevada	332	231	69.6
California	28, 627	28, 066	98.0
Connecticut	9, 418	8, 883	91.3
Rhode Island	3, 409	3, 278	96 2
Massachusetts	28, 315	27, 738	98.0
Michigan	20, 802	20, 767	99.8
Maryland	8. 431	8, 124	96.4
Illinois	36, 299	36, 084	99.4
New Jersey	22, 092	21, 240	96.1
Wyoming	914	887	97.0
Second quarter	134, 279	129, 953	96.8
Montana	1, 900	1, 845	97.1
Ohio	27, 196	26, 392	97.0
Washington	7, 577	7, 330	96.7
Pennsylvania	40, 946	40, 125	98.0
Oregon	4, 950	4, 779	96.5
Wisconsin	14, 762	13, 799	93 5
Colorado	4, 740	4, 391	92.6
Arizona	900	833	92.6
Minnesota	13, 428	13, 019	97.0
New Hampshire	2, 641	2, 622	99.3
Maine	3, 670	3, 357	91.5
Indiana	11, 569	11, 461	99.1
Third quarter	76, 766	74, 200	96.7
Florida	4, 819	4, 666	96.2
Utah	1, 392	1, 375	98.8
Idaho	1, 460	1, 445	99.0
Missouri	14, 071	13, 634	96.9
Vermont	2, 160	2, 056	95.2
Nebraska	5, 324	5, 270	99.0
Iowa	10, 573	10, 160	96.1
Kansas	6, 912	6, 651	96 2
New Mexico	856	832	97 2
West Virginia	3, 964	3, 793	95.7
Texas	14, 867	14, 325	96.4
Virginia	10, 335	9, 993	96.7
Fourth quarter	69, 028	66, 231	95.9
Louisiana	7, 099	6, 455	90 9
South Dakota	2, 390	2, 256	94.4
Oklahoma	8, 262	8, 265	100.0
North Dakota	3, 074	2, 597	84.5
Tennessee	6, 998	6, 664	95.2
Kentucky	7, 005	7, 126	101.7
Georgia	7, 644	7, 478	97.8
North Carolina	7, 555	7, 007	92.7
South Carolina	4, 846	4, 645	95.9
Alabama	6, 064	5, 934	97.9
Arkansas	4, 021	3, 944	98.1
Mississippi	4, 070	3, 860	94.8

[1] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[2] Bed totals represent tabulations of data for individual hospitals published in the Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938. Data for hospitals operated by Federal agencies are excluded. Only beds in hospitals that reported satisfactory information regarding average daily census are employed here.

TABLE 8.—*Estimated annual per capita payment for care in mental hospitals, by States arrayed in descending order of average per capita income 1935–37* [1]

State	Population (add 000) [2]	Per capita payment to hospitals [3]
United States	127, 521	$1.14
First quarter	45, 346	1.83
District of Columbia	594	(4)
Delaware	256	(4)
New York	12, 890	2.63
Nevada	99	(4)
California	5, 997	1.08
Connecticut	1, 717	2.08
Rhode Island	681	1.91
Massachusetts	4, 375	3.00
Michigan	4, 731	1.30
Maryland	1, 609	1.06
Illinois	7, 817	.98
New Jersey	4, 288	1.84
Wyoming	232	(4)
Second quarter	31, 725	1.02
Montana	531	(4)
Ohio	6, 707	.78
Washington	1, 633	1.06
Pennsylvania	10, 067	1.14
Oregon	1, 008	.80
Wisconsin	2, 908	1.75
Colorado	1, 062	1.02
Arizona	406	(4)
Minnesota	2, 627	.97
New Hampshire	502	1.77
Maine	845	.83
Indiana	3, 429	.69
Third quarter	23, 626	$0.66
Florida	1, 614	.79
Utah	515	(4)
Idaho	479	.44
Missouri	3, 913	.73
Vermont	377	2 07
Nebraska	1, 304	.88
Iowa	2, 534	.84
Kansas	1, 878	.77
New Mexico	422	(4)
West Virginia	1, 816	.33
Texas	6, 077	.49
Virginia	2, 637	.58
Fourth quarter	26, 824	.55
Louisiana	2, 120	.96
South Dakota	692	(4)
Oklahoma	2, 509	.54
North Dakota	700	(4)
Tennessee	2, 824	.48
Kentucky	2, 846	.37
Georgia	3, 035	1.16
North Carolina	3, 417	.25
South Carolina	1, 840	.46
Alabama	2, 834	.39
Arkansas	1, 999	(4)
Mississippi	2, 008	.28

[1] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[2] Population, as of July 1, 1935, estimated by the Bureau of the Census, Department of Commerce.

[3] Pennell, Elliott H., Mountin, Joseph W., and Pearson, Kay: Business Census of Hospitals, 1935, General Report. Supplement 154 to the Public Health Reports. U. S. Government Printing Office, 1939.

[4] Withheld to avoid disclosure of confidential information.

TABLE 9.—*Beds per 1,000 population in tuberculosis hospitals of different control, by States arrayed in descending order of average per capita income 1935–37* [1]

State	Population (add 000) [2]	Total beds [3]	Beds per 1,000 population in hospitals of specified control		
			All hospitals	State and local governments	Nongovernmental agencies
United States	129,257	70,584	0.55	0.43	0.12
First quarter	45,915	35,908	.78	.61	.17
District of Columbia	627	700	1.11	1.11	----------
Delaware	201	224	.86	.77	.09
New York	12,959	10,305	.80	.59	.21
Nevada	101	----------	----------	----------	----------
California	6,154	4,434	.72	.46	.26
Connecticut	1,741	1,925	1.11	.96	.15
Rhode Island	681	785	1.15	1.00	.15
Massachusetts	4,426	4,388	.99	.77	.22
Michigan	4,830	4,027	.83	.64	.19
Maryland	1,679	1,240	.74	.58	.16
Illinois	7,878	3,911	.50	.40	.10
New Jersey	4,343	3,936	.91	.80	.11
Wyoming	235	33	.14	.14	----------
Second quarter	32,034	18,151	.57	.44	.13
Montana	539	200	.37	.37	----------
Ohio	6,733	3,314	.49	.43	.06
Washington	1,658	1,004	.61	.52	.09
Pennsylvania	10,176	4,285	.42	.31	.11
Oregon	1,027	575	.56	.50	.06
Wisconsin	2,926	2,142	.73	.69	.04
Colorado	1,071	1,719	1.60	----------	1.60
Arizona	412	574	1.39	.33	1.06
Minnesota	2,652	2,084	.78	.76	.02
New Hampshire	510	240	.47	.27	.20
Maine	856	485	.57	.53	.04
Indiana	3,474	1,529	.44	.44	----------
Third quarter	23,999	8,689	.36	.30	.06
Florida	1,670	607	.36	.35	.01
Utah	519	----------	----------	----------	----------
Idaho	493	----------	----------	----------	----------
Missouri	3,989	2,014	.50	.44	.06
Vermont	383	204	.53	.33	.20
Nebraska	1,364	160	.12	.12	----------
Iowa	2,552	800	.31	.31	----------
Kansas	1,804	420	.23	.23	----------
New Mexico	422	385	.91	.15	.76
West Virginia	1,865	761	.41	.37	.04
Texas	6,172	2,128	.35	.25	.10
Virginia	2,706	1,210	.45	.42	.03
Fourth quarter	27,309	7,836	.20	.24	.05
Louisiana	2,132	326	.15	.05	.10
South Dakota	692	192	.28	.28	----------
Oklahoma	2,548	807	.32	.31	.01
North Dakota	706	405	.57	.57	----------
Tennessee	2,893	1,075	.37	.26	.11
Kentucky	2,920	682	.23	.23	----------
Georgia	3,085	603	.19	.18	.01
North Carolina	3,492	1,575	.45	.33	.12
South Carolina	1,875	578	.31	.27	.04
Alabama	2,895	391	.14	.11	.03
Arkansas	2,048	707	.35	.35	----------
Mississippi	2,023	495	.24	.22	.02

[1] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.
[2] Population, as of July 1, 1937, estimated by the Bureau of the Census, Department of Commerce.
[3] Bed totals represent tabulations of data for individual hospitals published in the Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938. Data for all hospitals operated by Federal agencies are excluded.

TABLE 10.—*Beds in tuberculosis hospitals and in tuberculosis departments of general hospitals per death from tuberculosis (all forms), by States arrayed in descending order of average per capita income 1935–37* [1]

State	Deaths from tuberculosis,[2] 1937	Total beds for tuberculosis [3]	Beds per death from tuberculosis	State	Deaths from tuberculosis [2]	Total beds for tuberculosis [3]	Beds per death from tuberculosis
United States	69, 324	81, 330	1. 17	Third quarter	12, 361	9, 369	0. 76
				Florida	960	862	. 90
First quarter	25, 063	41, 983	1. 68	Utah	113	48	. 42
District of Columbia	550	900	1. 64	Idaho	106	45	. 42
Delaware	141	224	1. 59	Missouri	2, 127	2, 040	. 96
New York	7, 320	12, 440	1. 70	Vermont	190	172	. 91
Nevada	95	11	. 12	Nebraska	263	243	. 92
California	4, 425	6, 817	1. 54	Iowa	542	811	1. 50
Connecticut	658	1, 676	2. 55	Kansas	485	417	. 86
Rhode Island	319	728	2. 28	New Mexico	533	491	. 92
Massachusetts	1, 908	4, 485	2. 35	West Virginia	998	820	. 82
Michigan	2, 137	4, 991	2. 34	Texas	4, 289	2, 124	. 50
Maryland	1, 405	1, 454	1. 03	Virginia	1, 755	1, 287	. 73
Illinois	4, 005	4, 361	1. 09				
New Jersey	2, 050	3, 854	1. 88	Fourth quarter	16, 408	8, 839	. 54
Wyoming	50	33	. 66	Louisiana	1, 511	659	. 44
				South Dakota	271	220	. 81
Second quarter	15, 402	21, 139	1. 36	Oklahoma	1, 217	805	. 66
Montana	241	200	. 83	North Dakota	179	405	2. 26
Ohio	3, 333	4, 002	1. 22	Tennessee	2, 445	1, 161	. 47
Washington	773	990	1. 28	Kentucky	2, 181	755	. 35
Pennsylvania	4, 906	5, 260	1. 07	Georgia	1, 573	641	. 41
Oregon	365	504	1. 63	North Carolina	1, 924	1, 659	. 86
Wisconsin	1, 037	2, 307	2. 22	South Carolina	969	905	. 93
Colorado	738	2, 130	2. 89	Alabama	1, 778	852	. 20
Arizona	1, 075	731	. 68	Arkansas	1, 073	755	. 70
Minnesota	911	2, 403	2. 64	Mississippi	1, 287	522	. 41
New Hampshire	143	240	1. 68				
Maine	287	567	1. 98				
Indiana	1, 683	1, 649	. 98				

[1] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[2] Vital Statistics—Special Reports, vol. 7, No. 26, Mar. 23, 1939. Bureau of the Census, Department of Commerce.

[3] Tuberculosis Hospital and Sanatorium Directory, 1938. National Tuberculosis Association. Data for all hospitals operated by Federal agencies are excluded.

TABLE 11.—*Percentage of beds occupied in tuberculosis hospitals, by States arrayed in descending order of average per capita income 1935–37* [1]

State	Total beds [2]	Average daily census	Percent of beds occupied	State	Total beds [2]	Average daily census	Percent of beds occupied
United States	66,815	57,208	85.6	Third quarter	7,863	6,537	83.1
First quarter	33,970	29,331	86.3	Florida	207	133	64.3
District of Columbia	700	394	56.3	Utah	--------	--------	--------
Delaware	224	168	75.0	Idaho	--------	--------	--------
New York	10,305	9,203	89.3	Missouri	1,984	1,656	83.5
Nevada	--------	--------	--------	Vermont	204	181	88.7
California	4,220	3,566	84.5	Nebraska	160	150	93.8
Connecticut	1,925	1,720	89.4	Iowa	800	638	79.8
Rhode Island	685	607	88.6	Kansas	420	396	94.3
Massachusetts	3,927	3,313	84.4	New Mexico	385	204	53.0
Michigan	3,877	3,252	83.9	West Virginia	761	675	88.7
Maryland	1,240	1,192	96.1	Texas	1,732	1,422	82.1
Illinois	3,227	2,825	87.5	Virginia	1,210	1,082	89.4
New Jersey	3,607	3,063	84.9	Fourth quarter	7,434	6,097	82.0
Wyoming	33	28	84.8	Louisiana	326	220	67.5
Second quarter	17,548	15,243	86.9	South Dakota	192	153	79.7
Montana	200	200	100.0	Oklahoma	807	675	83.6
Ohio	3,135	2,855	91.1	North Dakota	405	225	55.6
Washington	1,004	879	87.5	Tennessee	1,035	905	87.4
Pennsylvania	4,120	3,769	91.5	Kentucky	682	644	94.4
Oregon	575	509	88.5	Georgia	567	549	96.8
Wisconsin	2,142	1,948	90.9	North Carolina	1,332	1,111	83.4
Colorado	1,537	956	62.2	South Carolina	578	481	83.2
Arizona	534	329	61.6	Alabama	308	191	62.0
Minnesota	2,084	1,874	89.9	Arkansas	707	643	90.9
New Hampshire	240	184	76.7	Mississippi	495	300	60.6
Maine	485	459	94.6				
Indiana	1,492	1,281	85.9				

[1] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[2] Bed totals represent tabulations of data for individual hospitals published in the Journal of the American Medical Association, vol. 110, No. 13, Mar. 26, 1938. Data for hospitals operated by Federal agencies are excluded. Only beds in hospitals that reported satisfactory information regarding average daily census are employed here.

TABLE 12.—*Estimated annual per capita payment for care in tuberculosis hospitals, by States arrayed in descending order of average per capita income 1935–37* [1]

State	Population (add 000) [2]	Per capita payment to hospitals [3]	State	Population (add 000) [2]	Per capita payment to hospitals [3]
United States	127,521	$0.39	Third quarter	23,620	$0.19
First quarter	45,346	.62	Florida	1,614	(4)
District of Columbia	594	.55	Utah	515	----------
Delaware	256	.61	Idaho	479	----------
New York	12,890	.66	Missouri	3,913	.32
Nevada	99	----------	Vermont	377	.33
California	5,997	.55	Nebraska	1,304	(4)
Connecticut	1,717	1.15	Iowa	2,534	.17
Rhode Island	681	.93	Kansas	1,878	.18
Massachusetts	4,375	1.04	New Mexico	422	.27
Michigan	4,731	.55	West Virginia	1,816	.22
Maryland	1,609	.41	Texas	6,077	.17
Illinois	7,817	.32	Virginia	2,637	.23
New Jersey	4,288	.05	Fourth quarter	26,824	.16
Wyoming	232	(4)	Louisiana	2,120	(4)
Second quarter	31,725	.41	South Dakota	692	(4)
Montana	531	(4)	Oklahoma	2,509	.14
Ohio	6,707	.43	North Dakota	700	(4)
Washington	1,633	.35	Tennessee	2,821	.19
Pennsylvania	10,067	.25	Kentucky	2,846	.20
Oregon	1,008	.30	Georgia	3,035	.14
Wisconsin	2,908	.58	North Carolina	3,417	.24
Colorado	1,062	1.32	South Carolina	1,810	.16
Arizona	406	.82	Alabama	2,834	.05
Minnesota	2,627	.67	Arkansas	1,999	(4)
New Hampshire	502	(4)	Mississippi	2,008	(4)
Maine	845	.51			
Indiana	3,429	.27			

[1] Average per capita income computed from annual data published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

[2] Population, as of July 1, 1935, estimated by the Bureau of the Census, Department of Commerce.

[3] Pennell, Elliott H., Mountin, Joseph W., and Pearson, Kay: Business Census of Hospitals, 1935, General Report. Supplement 154 to the Public Health Reports. U. S. Government Printing Office, 1939. Data for hospitals operated by Federal agencies are excluded.

[4] Withheld to avoid disclosure of confidential information.

NATIONAL HOSPITAL BILL REPORTED OUT OF COMMITTEE

On April 30, 1940, the Senate Committee on Education and Labor reported favorably on the National Hospital Bill, and recommended that the bill pass as amended.

The bill as reported (which is a substitute for the original bill, the title of which was changed to "Hospital Construction Act of 1940") provides for a limited Federal program of hospital construction and leasing, equipment, and for assistance toward the maintenance of such hospitals.

The fundamental purpose of the bill is to assist "States, counties, health or hospital districts, and other subdivisions of the States in providing better health and medical services through the construction, improvement, and enlargement of needed hospitals, especially in rural communities and economically depressed areas."

The principal findings and conclusions of the Committee, upon which the recommendation of the bill is based, may be summarized in brief as follows:

Among the counties of the United States, 1,338, with a total population of 17,000,000, do not have a registered general hospital. Remoteness from metropolitan centers, a small percentage of urban population, and a low tax income characterize these counties.

It is in these communities, without adequate hospital facilities and without evidence that in the normal course of events private hospital construction will ever meet community needs, that the provisions of the bill will apply.

All areas of the country should have the protection of modern public health services and opportunity for adequate care in sickness.

The great differences in the economic ability of the States and communities to provide and operate hospitals should be equalized.

The Committee finds, "on the basis of incontrovertible evidence, that without a reasonable amount of Federal assistance to the States for the construction of public hospitals, it cannot be expected that there will ever be any fair degree of equality in the location of such facilities."

The bill authorizes six annual appropriations of $10,000,000, the first, for the fiscal year 1941, to be used for the construction of needed hospitals, and the subsequent appropriations to be used as grants to States, counties, health or hospital districts, alone or in combination, for the improvement and enlargement of needed hospitals, and to assist in the maintenance of any such hospitals and the training of personnel.

It also authorizes the appropriation, for the five fiscal years beginning with the fiscal year 1947, of such sums as may be necessary during such period for hospital maintenance grants.

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The bill provides that the act is to be administered by the Surgeon General of the Public Health Service, subject to the direction and supervision of the Federal Security Administrator. The Surgeon General is authorized to consult with other Federal health and welfare agencies and to perform certain specified important functions in connection with the operation of the Act, after consultation with the National Advisory Hospital Council.

The bill provides for the creation of the National Advisory Hospital Council, consisting of nine members. This Council is given the power to pass on all hospital construction projects under the appropriation made for the fiscal year 1941 and is subsequently vested with advisory power only.

In a message to Congress on January 30, 1940, the President recommended the passage of enabling legislation and an appropriation for the construction of small hospitals in needy areas of the country, "especially in rural areas not now provided with them." In that message he stated that, "Hospitals are essential to physicians in giving modern medical service to the people. In many areas present hospital facilities are almost nonexistent. The most elementary needs are not being met."

In the course of the hearings on this proposed legislation it developed that the support of the basic purposes was practically unanimous.

DIPHTHERIA AND DIPHTHERIA IMMUNIZATION IN ENGLAND AND WALES

The British Ministry of Health has recently issued a memorandum recommending that the advantages of immunization against diphtheria be brought to the notice of parents of children over 1 year of age so that requisite consent may be secured for the immunizing procedure.[1] The memorandum recommends dispensing with the Schick test in routine immunization. It points out that, in districts where diphtheria is endemic, the infection is disseminated, with the result that a large proportion of the population becomes immunized before the end of school life, but at a heavy cost in sickness and death, whereas artificial immunization, when properly performed, involves no risk.

The Ministry points out that the experience of the United States and Canada shows that, if three-fourths of the children at each age below 15 were immune and if this level should be maintained year by year, diphtheria would be practically eliminated.

Immunization in Great Britain has never been practiced on as large a scale as it has in the United States and Canada. In 1938 England and Wales had twice as many cases of diphtheria as the United States and 15 percent more deaths from the disease, with less than one-third

[1] Foreign Letter—London. J. Am Med. Assoc, 114: 1470 (Apr. 13, 1940).

the population. In that year England and Wales, with approximately 41,000,000 population, recorded 65,008 cases and 2,931 deaths, as compared with 30,508 cases and 2,500 deaths in the United States (130,000,000 estimated population).

For children under 8 years of age, a dose of 0.1 cc. of alum-precipitated toxoid followed after 4 weeks by 0.5 cc. is recommended. For older children and adults, the first dose of 0.1 cc. serves to detect unusual sensitiveness. Two further similar doses are advocated at intervals of 2 or 3 weeks; but if the person is not unduly sensitive, the same procedure as that for younger children is advised. A Schick test is recommended not less than 2 months after the last injection.

COURT DECISION ON PUBLIC HEALTH

Pollution of city water supply.—(Mississippi Supreme Court, Division A; *Carey-Reed Co., Inc.*, v. *Farmer*, 192 So. 48; decided November 20, 1939.) An action was brought to recover damages for injuries alleged to have resulted from drinking water from a city supply which the plaintiff claimed had become polluted through the negligence of a company engaged in laying a concrete paving on a highway between two municipalities about three miles apart. The evidence for the plaintiff tended to establish, among other things, the following: A bayou ran through the city of Cleveland on south through the town of Boyle, which bayou received the greater part of the sewage from both places and the residences between them and was, therefore, highly polluted at all times. The company had a water line which, while the work was going on near Cleveland, was connected with that city's water supply. When the work had progressed for such a distance from Cleveland that the pressure from that city's water main was insufficient to supply the required amount of water, the company, without the knowledge or consent of the authorities of Cleveland, extended its line to the bayou and installed a force pump at Boyle, after which the company had an unbroken water line from the force pump at Boyle to the water main at Cleveland. The company failed to install a safety valve at the proper place in the line to prevent the water from the bayou being pumped into the Cleveland water supply. On a certain date the pump at Boyle ran all night, its pressure gauge registering 125 lbs. while the pressure at the fireplug at the Cleveland end did not exceed 40 lbs. On ascertaining for the first time that the company's water line was connected with both the Cleveland main and the bayou, the water commissioner of Cleveland immediately disconnected the line at the fireplug and when this was done the water from the pipe coming from Boyle had sufficient pressure to throw a stream a distance of from 10 to 15 feet. A survey showed that, out of 366 people in the area surrounding the fire hydrant,

157 were sick, and the conclusion reached by the health authorities was that the sickness was acute gastroenteritis caused by polluted water.

The evidence on behalf of the company was contradictory of some of the material evidence necessary to support the plaintiff's case but there was a verdict for the plaintiff for $3,000 and the company appealed from the judgment thereon.

The appellant argued that it was entitled to a directed verdict because the evidence fell short of tending to establish negligence in a substantial way. The supreme court said that the question was whether the appellant negligently polluted the water in the water main in the area surrounding the city fire hydrant to which appellant's water line was attached. Stating that it was of the opinion that the question should be answered in the affirmative, the court said it reached that conclusion upon the following considerations:

> * * * The bayou water was so polluted as to be unfit for human consumption; it was dangerous to the health of those drinking it. Its contamination was sufficient to cause the character of ailments suffered by appellee and others in the affected area. Appellant is bound to have known, as everyone did, that the bayou was a sewage receptacle to a large extent of the city of Cleveland and the town of Boyle, as well as along the way between the two places. Appellant must have known that greater pressure at the pump end of its water line than at the other end would result in forcing the bayou water into Cleveland's water supply. The fact, which was undisputed, that the outbreak of sickness was confined alone to the area around the Cleveland connection of the pipe line and the balance of the inhabitants of the city were unaffected, is strong evidence that the pollution was from the bayou water and not from any other source. The evidence showed that by the installation of a safety valve, which would have cost little, the possibility of the city water being contaminated by the bayou water would have been avoided. * * *

In affirming the judgment the appellate court also stated that "Although the verdict seems large, we cannot say with absolute confidence that it is so large as to evince passion or prejudice on the part of the jury."

DEATHS DURING WEEK ENDED APRIL 20, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Apr. 20, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,784	8,967
Average for 3 prior years	8,931	
Total deaths, first 16 weeks of year	149,774	149,959
Deaths under 1 year of age	444	521
Average for 3 prior years	538	
Deaths under 1 year of age, first 16 weeks of year	8,198	8,758
Data from industrial insurance companies:		
Policies in force	65,744,823	67,479,316
Number of death claims	12,840	17,925
Death claims per 1,000 policies in force, annual rate	10.2	13.9
Death claims per 1,000 policies, first 16 weeks of year, annual rate	10.7	11.7

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MAY 4, 1940

Summary

The incidence of each of the nine communicable diseases reported weekly by telegraph by the State health officers remained low for the week ended May 4, 1940. Reports show decreases for diphtheria, influenza, scarlet fever, and whooping cough, slight increases for measles, meningococcus meningitis, smallpox, and typhoid fever, with poliomyelitis unchanged, as compared with the preceding week, and all except influenza are below the 5-year (1935–39) median expectancy for the current week.

For the country as a whole the incidence of smallpox this year has been the lowest on record. For the week ended May 4, there were 95 cases reported (11 in Alabama, 13 in Iowa, 12 in Oklahoma, and 18 in Texas) as compared with 296 in 1939, 454 in 1938, and a 5-year median expectancy of 252. Only 115 cases of typhoid fever were reported for the current week (24 in Ohio), as compared with the 5-year median of 132.

The number of deaths in 88 large cities, as reported to the Bureau of the Census for the current week, was 8,458 as compared with 8,484 for the preceding week and with a 3-year (1937–39) average of 8,268.

The infant mortality in these 88 large cities has been unusually favorable this year. For the current week, 491 deaths of infants under 1 year of age were reported, as compared with 504 last week and with a 3-year average of 513. The total number of infant deaths for the first 18 weeks of this year, ended with the week of May 4, was 9,193 as compared with 9,727 last year and with a 3-year average of 9,745.

Telegraphic morbidity reports from State health officers for the week ended May 4, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	May 4, 1940	May 6, 1939		May 4, 1940	May 6, 1939		May 4, 1940	May 6, 1939		May 4, 1940	May 6, 1939	
NEW ENG.												
Maine	1	0	1	1	154	8	566	56	176	0	0	0
New Hampshire	0	0	0	------	------	------	0	2	50	0	0	0
Vermont	0	1	0	------	------	------	2	44	44	0	0	0
Massachusetts	0	5	5	------	------	------	566	1,264	683	2	2	4
Rhode Island	0	0	0	------	------	------	200	66	66	1	0	1
Connecticut	3	0	5	8	3	3	76	929	373	1	0	0
MID. ATL.												
New York	12	15	39	[1] 16	[1] 14	[1] 7	713	2,181	2,825	3	5	9
New Jersey	4	5	12	6	6	10	786	36	1,070	1	3	3
Pennsylvania	23	33	34	------	------	------	445	135	1,135	5	5	9
E. NO. CEN.												
Ohio	3	30	23	26	------	6	19	42	1,015	0	1	5
Indiana	9	8	5	10	11	16	17	19	467	0	0	2
Illinois	18	20	27	13	38	38	121	32	274	1	3	7
Michigan [2]	2	15	11	12	------	2	623	584	584	1	1	2
Wisconsin	0	1	3	38	56	56	680	803	803	1	2	1
W. NO. CEN.												
Minnesota	1	1	3	5	1	2	116	468	468	0	0	3
Iowa	5	3	2	------	2	6	191	259	253	0	0	0
Missouri	7	1	4	5	2	31	23	5	20	2	0	1
North Dakota	1	2	1	2	12	5	4	20	20	0	0	0
South Dakota	1	0	1	1	2	2	5	199	6	3	0	0
Nebraska	0	1	2	------	9	------	24	244	233	0	0	1
Kansas	1	6	6	7	3	4	653	62	62	0	0	1
SO. ATL.												
Delaware	0	0	1	------	------	------	0	0	10	0	1	0
Maryland [2]	7	3	6	6	7	8	3	292	292	0	1	6
Dist. of Col.	0	2	5	------	------	------	3	814	103	0	1	1
Virginia	4	8	13	110	254	------	196	807	490	3	0	8
West Virginia [3]	7	4	9	41	48	35	60	4	66	1	3	9
North Carolina [3]	11	16	12	10	21	30	100	866	341	2	1	1
South Carolina	5	5	4	400	471	211	25	13	55	0	2	1
Georgia [3]	3	8	3	38	251	------	148	111	------	1	0	1
Florida	1	2	3	1	50	5	220	209	28	0	1	1
E. SO. CEN.												
Kentucky	4	4	5	12	30	16	95	73	206	3	3	7
Tennessee	2	4	7	16	74	74	190	45	58	1	0	7
Alabama [3]	5	1	6	45	419	174	63	264	175	1	1	3
Mississippi [2] [3]	2	7	5	------	------	------	------	------	------	0	1	1
W. SO. CEN.												
Arkansas	3	7	4	58	151	66	20	155	60	0	0	0
Louisiana [3]	2	9	11	14	30	16	6	92	70	2	2	1
Oklahoma	2	6	6	80	140	75	25	251	194	2	1	3
Texas [3]	33	19	30	872	533	365	1,120	495	495	2	1	2
MOUNTAIN												
Montana	2	1	3	16	64	18	90	49	35	0	0	0
Idaho	0	0	0	------	1	1	22	95	29	0	0	0
Wyoming [4]	0	2	2	------	------	------	52	115	25	0	0	0
Colorado [5]	15	16	5	10	8	------	51	384	247	1	0	0
New Mexico	0	0	3	------	5	1	36	20	38	0	0	0
Arizona	1	1	1	109	50	32	104	39	39	1	0	0
Utah [2]	0	0	0	------	26	------	694	77	36	0	0	0
PACIFIC												
Washington	0	0	2	------	------	------	712	840	390	0	1	2
Oregon [4]	4	0	0	9	37	28	591	88	88	1	0	0
California	11	28	28	35	36	48	259	2,673	1,595	1	1	1
Total	215	295	395	1,532	3,019	1,411	10,721	15,821	15,821	43	43	138
18 weeks	6,185	8,180	9,654	160,776	141,425	129,958	127,341	242,810	242,810	714	897	2,487

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 4, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	May 4, 1940	May 6, 1939		May 4, 1940	May 6, 1939		May 4, 1940	May 6, 1939		May 4, 1940	May 6, 1939	
NEW ENG.												
Maine	0	0	0	15	19	18	0	0	0	1	0	0
New Hampshire	0	0	0	4	0	8	0	0	0	0	0	0
Vermont	0	0	0	4	4	9	0	0	0	0	1	0
Massachusetts	0	0	0	151	156	251	0	0	0	10	0	1
Rhode Island	0	0	0	12	7	12	0	0	0	0	0	0
Connecticut	0	0	0	93	77	84	0	0	0	0	0	0
MID ATL.												
New York	0	2	2	1,100	613	910	0	1	0	5	4	6
New Jersey	0	0	0	383	223	188	0	0	0	3	4	4
Pennsylvania	1	0	0	495	388	590	0	0	0	7	7	8
E. NO. CEN.												
Ohio	1	0	0	325	330	330	0	25	0	24	9	6
Indiana	0	0	0	114	167	150	6	35	23	8	1	1
Illinois	0	0	0	800	451	618	2	4	7	2	0	4
Michigan [2]	0	0	0	356	449	374	1	12	3	0	3	3
Wisconsin	0	0	0	122	206	296	1	0	11	0	0	0
W. NO. CEN.												
Minnesota	1	0	0	84	77	142	2	10	10	0	0	0
Iowa	0	0	0	53	141	141	13	43	36	2	6	1
Missouri	0	0	0	73	81	192	3	41	10	1	3	2
North Dakota	0	0	0	9	3	30	7	1	4	0	1	1
South Dakota	0	0	0	15	14	14	1	20	18	0	1	0
Nebraska	0	0	0	6	23	57	4	2	17	0	0	0
Kansas	1	0	0	61	60	98	0	2	15	3	1	1
SO. ATL.												
Delaware	0	0	0	9	5	5	0	0	0	0	0	0
Maryland [2]	1	0	0	33	30	72	0	0	0	2	1	1
Dist. of Col	0	0	0	35	14	20	0	0	0	1	1	1
Virginia	0	1	1	63	31	31	0	0	0	2	1	3
West Virginia [2]	0	0	0	41	30	46	0	0	0	8	3	5
North Carolina [2]	1	1	1	36	21	19	2	0	0	0	2	2
South Carolina	0	13	0	3	2	2	0	0	0	4	3	3
Georgia [2]	0	3	0	13	12	8	0	0	0	2	1	7
Florida	0	3	1	3	5	6	0	1	0	1	4	4
E. SO. CEN.												
Kentucky	0	0	0	83	38	38	0	1	1	5	6	4
Tennessee	0	0	0	85	42	23	0	1	0	2	2	3
Alabama [2]	0	1	1	12	4	4	11	1	1	1	5	3
Mississippi [2,3]	0	1	0	10	1	6	1	0	0	1	1	1
W. SO. CEN.												
Arkansas	0	1	1	1	1	3	2	0	0	5	3	2
Louisiana [2]	0	0	0	6	8	13	0	0	0	2	7	7
Oklahoma	1	1	0	18	20	20	12	49	3	3	3	3
Texas [2]	2	1	0	26	41	73	18	14	7	3	10	10
MOUNTAIN												
Montana	0	0	0	81	19	19	0	0	8	1	1	1
Idaho	0	0	0	5	2	10	0	3	3	0	0	0
Wyoming [4]	0	0	0	9	11	18	0	0	4	0	1	0
Colorado [4]	2	0	0	30	39	39	4	0	5	0	1	0
New Mexico	0	0	0	7	2	11	0	0	0	1	1	3
Arizona	0	1	0	6	21	18	0	4	0	0	3	1
Utah [2]	0	0	0	7	11	15	0	0	0	0	0	0
PACIFIC												
Washington	0	0	0	48	31	34	0	3	10	1	1	1
Oregon [4]	0	0	0	13	12	26	4	12	12	0	6	0
California	2	3	3	122	148	199	[6] 1	11	12	4	8	5
Total	13	32	21	5,030	4,099	6,338	95	296	252	115	125	132
18 weeks	425	324	359	86,737	90,400	123,493	[6] 1,332	6,446	5,737	1,461	2,076	2,076

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 4, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended— May 4, 1940	Whooping cough, Week ended— May 6, 1939
NEW ENG.		
Maine	20	67
New Hampshire	11	0
Vermont	35	33
Massachusetts	166	154
Rhode Island	17	63
Connecticut	11	46
MID. ATL.		
New York	279	446
New Jersey	124	265
Pennsylvania	350	327
E. NO. CEN.		
Ohio	173	157
Indiana	27	59
Illinois	98	198
Michigan [2]	157	143
Wisconsin	143	139
W. NO. CEN.		
Minnesota	18	30
Iowa	38	10
Missouri	11	15
North Dakota	7	4
South Dakota	1	1
Nebraska	9	2
Kansas	40	32
SO. ATL.		
Delaware	17	10
Maryland [2]	142	24
Dist. of Col.	4	28
Virginia	32	61
West Virginia [2]	33	20
North Carolina [3]	67	285
SO. ATL.—continued		
South Carolina	27	99
Georgia [3]	21	39
Florida	7	69
E. SO. CEN.		
Kentucky	123	6
Tennessee	47	40
Alabama [3]	35	40
Mississippi [2 3]	---------	---------
W. SO. CEN.		
Arkansas	80	14
Louisiana [3]	13	6
Oklahoma	37	4
Texas [3]	291	139
MOUNTAIN		
Montana	0	4
Idaho	3	0
Wyoming [4]	4	2
Colorado [5]	4	69
New Mexico	50	41
Arizona	11	13
Utah [2]	153	47
PACIFIC		
Washington	64	27
Oregon [4]	20	15
California	354	262
Total	3,330	3,555
18 weeks	55,202	72,625

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended May 4, 1940, 20 cases as follows: North Carolina, 1; Georgia, 6; Alabama, 3; Mississippi, 1; Louisiana, 2; Texas, 7.
[4] Rocky Mountain spotted fever, week ended May 4, 1940, 5 cases as follows: Wyoming, 3; Oregon, 2.
[5] Colorado tick fever, week ended May 4, 1940, Colorado, 2 cases.
[6] Two cases of smallpox were reported in California during the week ended Apr. 6, 1940, instead of no cases as shown in the Public Health Reports of Apr. 12, p. 659.

WEEKLY REPORTS FROM CITIES

City reports for week ended Apr. 20, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	139	207	70	7,377	720	2,301	22	400	20	1,240	--------
Current week	60	102	45	2,209	441	1,022	2	369	17	1,009	--------
Maine:											
Portland	0	--------	0	125	3	2	0	0	0	8	23
New Hampshire:											
Concord	0	--------	0	1	0	0	0	0	0	0	8
Manchester	0	--------	1	1	0	0	0	0	0	0	15
Nashua	0	--------	0	1	0	0	0	0	0	0	4
Vermont:											
Barre	0	--------	0	0	0	0	0	0	0	0	1
Burlington	0	--------	0	1	0	0	0	0	0	2	10
Rutland	0	--------	1	0	0	0	0	0	0	0	10
Massachusetts:											
Boston	0	--------	0	77	20	52	0	12	0	50	230
Fall River	0	--------	0	23	1	0	0	1	0	5	23
Springfield	0	--------	0	1	0	7	0	2	0	4	31
Worcester	0	--------	0	15	13	4	0	2	0	1	50
Rhode Island:											
Providence	0	2	2	124	1	21	0	1	0	6	65
Connecticut:											
Bridgeport	0	--------	--------	1	1	3	0	0	0	2	28
Hartford	0	--------	0	1	3	5	0	1	0	5	34
New Haven	0	2	0	0	0	3	0	1	0	3	39
New York:											
Buffalo	0	--------	0	0	7	8	0	4	0	5	145
New York	17	15	1	96	88	657	0	91	1	151	1,593
Rochester	0	2	0	6	5	18	0	0	0	14	85
Syracuse	0	--------	0	0	2	14	0	0	0	1	62
New Jersey:											
Camden	0	1	1	0	0	13	0	0	0	0	19
Newark	0	3	0	269	2	23	0	5	0	34	106
Trenton	0	--------	0	0	4	3	0	1	0	0	43
Pennsylvania:											
Philadelphia	0	--------	1	0	24	0	0	29	0	0	478
Pittsburgh	0	5	5	1	8	30	0	10	0	9	176
Reading	0	--------	0	0	0	0	0	0	1	6	21
Scranton	0	--------	0	0	0	1	0	0	0	0	1
Ohio:											
Cincinnati	4	1	0	4	3	8	0	7	0	35	138
Cleveland	1	25	2	2	12	48	0	7	0	36	204
Columbus	0	--------	0	0	1	6	0	1	0	13	68
Toledo	0	1	1	5	6	41	0	4	0	18	79
Indiana:											
Anderson	0	--------	0	1	2	0	0	0	0	4	13
Fort Wayne	0	--------	1	0	3	2	0	0	0	4	23
Indianapolis	1	--------	3	1	6	20	0	3	0	9	112
Muncie	0	--------	0	0	1	1	0	1	0	1	10
South Bend	0	--------	0	0	1	0	0	0	0	0	13
Terre Haute	1	--------	0	0	1	2	0	0	0	2	13
Illinois:											
Alton	0	--------	0	0	2	4	0	0	0	4	18
Chicago	9	2	5	38	38	568	0	26	3	40	764
Elgin	0	--------	0	1	1	2	0	0	0	0	8
Moline	0	--------	0	3	0	1	0	0	0	0	6
Springfield	0	1	1	0	5	3	0	0	0	3	25
Michigan:											
Detroit	1	1	1	96	17	69	0	12	1	44	294
Flint	1	--------	0	5	6	28	0	2	0	6	25
Grand Rapids	0	--------	0	8	1	21	0	1	0	20	34
Wisconsin:											
Kenosha	0	--------	0	37	0	1	0	1	0	0	8
Madison	0	--------	0	0	1	4	0	0	0	2	15
Milwaukee	0	1	1	40	4	26	0	3	0	1	109
Racine	0	--------	0	1	0	1	0	0	0	0	15
Superior	0	--------	0	88	1	1	0	0	0	0	12
Minnesota:											
Duluth	0	--------	0	57	2	1	0	0	0	0	36
Minneapolis	1	--------	1	2	6	15	0	1	0	8	108
St. Paul	0	--------	0	4	7	15	0	0	0	14	56

City reports for week ended Apr. 20, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Iowa:											
Cedar Rapids	0	--------	--------	69	--------	2	0	--------	0	0	--------
Davenport	0	--------	--------	4	--------	5	0	--------	0	0	--------
Des Moines	0	--------	0	23	0	12	5	0	0	0	48
Sioux City	0	--------	--------	0	--------	0	0	--------	0	0	--------
Waterloo	0	--------	--------	6	--------	1	0	--------	0	1	--------
Missouri:											
Kansas City	0	--------	0	12	5	15	0	5	0	0	92
St. Joseph	0	--------	0	0	2	0	0	0	0	0	27
St. Louis	4	--------	0	2	11	24	0	5	2	13	234
North Dakota:											
Fargo	0	--------	0	0	0	0	2	0	0	0	8
Grand Forks	0	--------	--------	0	--------	0	0	--------	0	0	--------
Minot	0	--------	0	0	0	1	0	0	0	0	4
South Dakota:											
Aberdeen	0	--------	--------	0	--------	0	0	--------	0	2	--------
Sioux Falls	0	--------	0	0	0	5	0	0	0	0	8
Nebraska:											
Lincoln	0	--------	--------	1	--------	0	0	--------	0	1	--------
Omaha	0	--------	0	3	6	7	0	1	0	1	55
Kansas:											
Lawrence	0	--------	1	1	0	0	0	0	0	0	8
Topeka	1	--------	0	19	3	0	0	0	0	0	16
Wichita	0	--------	0	44	3	0	0	1	0	4	37
Delaware:											
Wilmington	0	--------	0	0	0	5	0	2	0	6	25
Maryland:											
Baltimore	1	4	0	1	12	16	0	15	0	130	242
Cumberland	0	--------	0	0	0	0	0	0	0	0	12
Frederick	0	--------	0	0	0	0	0	0	0	0	2
Dist. of Col.:											
Washington	0	2	2	4	6	19	0	13	0	7	160
Virginia:											
Lynchburg	0	--------	0	1	1	2	0	0	0	31	17
Norfolk	0	--------	0	4	2	10	0	5	0	0	31
Richmond	1	--------	1	0	5	3	0	5	0	1	70
Roanoke	0	--------	0	9	1	1	0	0	0	0	17
West Virginia:											
Charleston	1	--------	0	0	0	0	0	0	0	0	5
Huntington	3	--------	--------	0	--------	2	0	--------	0	0	--------
Wheeling	0	--------	0	0	3	0	0	1	0	2	16
North Carolina:											
Gastonia	0	--------	--------	0	--------	0	0	--------	0	0	--------
Raleigh	0	--------	0	0	3	0	0	0	0	0	10
Wilmington	0	--------	0	0	0	0	0	0	0	0	9
Winston-Salem	0	1	0	1	3	2	0	1	0	0	12
South Carolina:											
Charleston	0	4	0	0	0	0	0	0	0	0	18
Florence	0	--------	0	0	1	0	0	0	0	0	10
Greenville	0	--------	0	0	0	0	0	0	0	2	6
Georgia:											
Atlanta	0	--------	1	9	3	1	0	5	0	0	89
Brunswick	0	--------	0	1	0	0	0	0	0	0	6
Savannah	0	1	0	0	2	1	0	3	0	0	40
Florida:											
Miami	0	2	1	1	3	0	0	2	0	0	37
Tampa	0	2	2	42	0	0	0	0	0	2	27
Kentucky:											
Ashland	0	--------	0	0	0	0	0	0	0	3	7
Covington	2	--------	0	6	0	1	0	1	0	0	15
Lexington	0	--------	0	10	3	1	0	1	0	11	16
Louisville	1	1	0	4	7	34	0	2	1	37	70
Tennessee:											
Knoxville	0	2	0	3	1	5	0	1	0	0	31
Memphis	0	4	2	31	6	27	0	8	2	12	80
Nashville	0	--------	1	13	4	4	0	1	0	6	66
Alabama:											
Birmingham	0	2	1	6	2	3	0	7	1	2	79
Mobile	0	--------	1	0	1	0	0	0	0	0	17
Montgomery	0	--------	--------	5	--------	1	0	--------	0	1	--------
Arkansas:											
Fort Smith	0	--------	--------	0	--------	0	0	--------	0	0	--------
Little Rock	0	4	0	0	8	1	0	0	0	0	--------
Louisiana:											
New Orleans	3	2	1	6	10	5	0	17	3	5	145
Shreveport	0	--------	0	0	6	0	0	1	1	0	47

City reports for week ended Apr. 20, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Oklahoma:											
Oklahoma City	0		0	0	5	1	1	1	0	0	46
Tulsa	0			13		0	0		0	39	
Texas:											
Dallas	1	2	2	186	6	0	0	2	1	48	64
Forth Worth	0		0	2	6	1	0	0	0	8	33
Galveston	0		0	1	3	1	0	0	0	0	19
Houston	1		0	15	7	2	0	6	2	3	80
San Antonio	0		1	19	6	0	0	7	0	7	52
Montana:											
Billings	0		1	0	1	0	0	0	0	0	8
Great Falls	0		0	1	2	6	0	0	0	0	10
Helena	0		0	0	0	0	0	0	0	0	2
Missoula	0		0	0	1	0	0	0	0	0	6
Idaho:											
Boise	0		0	0	0	0	0	1	0	0	8
Colorado:											
Colorado Springs	0		0	0	0	6	0	0	0	2	14
Denver	7		0	20	2	5	0	4	0	2	87
Pueblo	0		0	4	0	6	0	0	0	0	9
New Mexico:											
Albuquerque	0		0	0	0	0	0	2	0	10	6
Utah:											
Salt Lake City	0		0	247	0	7	0	0	0	56	48
Washington:											
Seattle	0		3	335	8	3	0	3	0	31	100
Spokane	0		0	5	0	4	0	1	0	3	32
Tacoma	0		0	5	1	10	0	1	0	0	27
Oregon:											
Portland	0	2	0	234	8	2	0	0	0	15	71
Salem	0			5		0	0		0	0	
California:											
Los Angeles	1	12	1	33	8	30	0	21	0	34	362
Sacramento	2		0	12	0	1	0	2	0	43	26
San Francisco	1	1	0	4	4	13	0	6	0	21	152

State and city	Meningitis, meningococcus Cases	Meningitis, meningococcus Deaths	Poliomyelitis cases
New York:			
Buffalo	2	1	0
Pennsylvania:			
Pittsburgh	3	1	1
Scranton	1	1	0
Ohio:			
Toledo	1	1	0
Wisconsin:			
Madison	1	0	0
Minnesota:			
St. Paul	0	0	1
Maryland:			
Baltimore	1	1	0
Kentucky:			
Louisville	0	1	0
Oklahoma:			
Tulsa	1	1	0
Texas:			
Houston	0	0	1

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Columbus, 1; Wichita, 2.
Pellagra.—Cases: Charleston, S. C., 3; Birmingham, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended April 6, 1940.—During the week ended April 6, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			1	2	8			1	1	8
Chickenpox		8		361	423	47	19	11	107	976
Diphtheria			2	7		2	12	2		25
Dysentery				24	2					26
Influenza		30			62				9	101
Lethargic encephalitis						1				1
Measles	1	16		230	588	601	382	1	107	1,926
Mumps		1		31	491	7	49		6	585
Pneumonia	4	10			19	5	2		17	57
Scarlet fever	1	18	4	84	146	13	36	15	8	325
Trachoma									1	1
Tuberculosis	4	12	13	40	52	21		1		143
Typhoid and paratyphoid fever			2	16		14	1			33
Whooping cough	2	5	1	193	66	25	47	11	39	389

JAMAICA

Communicable diseases—4 weeks ended February 17, 1940.—During the 4 weeks ended February 17, 1940, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	2	3	Leprosy		2
Diphtheria	8	3	Puerperal sepsis		3
Dysentery	8	23	Tuberculosis	28	73
Erysipelas		1	Typhoid fever	5	60

YUGOSLAVIA

Communicable diseases—4 weeks ended March 24, 1940.—During the 4 weeks ended March 24, 1940, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	22	8	Paratyphoid fever	11	
Cerebrospinal meningitis	802	168	Poliomyelitis	3	1
Diphtheria and croup	577	52	Scarlet fever	239	2
Dysentery	18	2	Sepsis	11	2
Erysipelas	188	13	Tetanus	8	5
Favus	8		Typhoid fever	162	26
Leprosy	1		Typhus fever	48	5
Lethargic encephalitis	2	1			

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of April 26, 1940, pages 745-749. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Smallpox

Algeria—Philippeville.—During the period March 11-20, 1940, 1 case of smallpox was reported in Philippeville, Algeria.

Sumatra—Medan.—During the week ended March 9, 1940, 1 case of smallpox was reported in Medan, Sumatra.

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Public Health Reports

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IN THIS ISSUE

U.S. PUBLIC HEALTH SERVICE 1798

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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CONTENTS

Public Health Reports

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DURATION OF ILLNESS FROM SPECIFIC DISEASES AMONG 9,000 FAMILIES, BASED ON NATION-WIDE PERIODIC CANVASSES, 1928-31 [1]

By SELWYN D. COLLINS, *Principal Statistician, United States Public Health Service*

CONTENTS

Mortality statistics consider only numbers of deaths without regard to duration of the illness that preceded death. The fatal outcome of the case marks it as belonging to the most severe category whether death came without preceding illness, as in an accident, or whether it came only after a prolonged period of confinement to bed, as with some chronic diseases.

Morbidity statistics, on the other hand, must consider more than the number of cases, for illnesses vary so greatly in severity that a count of cases does not indicate the magnitude of the sickness problem. The durations of illness in terms of the total days that the symptoms lasted, the days of inability to work or pursue other usual activities, and the days confined to bed are important supplements to case rates which help to indicate the extent of illness from all causes and from given diseases.

Durations of illness as recorded in sickness surveys are not precise. The informant frequently can give only approximations which tend

[1] From Statistical Investigations, Division of Public Health Methods, National Institute of Health.

This is the fifteenth of a series of papers on sickness and medical care in this group of families (*1-14*). The survey of these families was organized and conducted by the Committee on the Costs of Medical Care; the tabulation was done under a cooperative arrangement between the Committee and the Public Health Service. Committee publications based on the results deal primarily with costs and Public Health Service publications primarily with the incidence of illness and the extent and kind of medical care, without regard to cost. As costs are meaningless without some knowledge of the extent and nature of the service received, there is inevitably some overlapping. The committee staff, particularly Dr. I. S. Falk and Miss Margaret Klem, cooperated in the tabulation of the data.

Special thanks are due to Dr. Mary Gover, who assisted in the analysis; to Mrs. Lily Vanzee Welch, who was in immediate charge of tabulating the data; and to other members of the statistical staff of the Public Health Service for advice and assistance in the preparation of the study.

to be stated in such round numbers as 3, 5, 7, or 10 days, as 1, 2, or 3 weeks, and often in months only. However, such approximations may yield reasonably good average durations and it may also be worth tabulating distributions of cases according to duration if the class intervals are arranged so that the round numbers most frequently used in reporting are at or near the midpoints of the classes.

I. SOURCE AND CHARACTER OF DATA

In the study of illness in a group of families in 18 States [2] that was made by the Committee on the Costs of Medical Care (*16*) and the United States Public Health Service, the record for each illness included 3 types of duration within the 12-month study period: (*a*) Total duration of symptoms (days sick), (*b*) days of inability to work or pursue other usual activities (disability), and (*c*) days confined to bed. These records of duration afford data for computing days of the various kinds per case of illness. A preceding paper (*14*) was devoted to days of sickness per 1,000 population.

The composition and characteristics of the group of 8,758 families which were kept under observation for 12 consecutive months in the years 1928–31 have been considered in some detail in the first report in the series (*1*). These families, including a total of 39,185 individuals, resided in 130 localities in 18 States representing all geographic sections. Every size of community was included, from metropolitan districts to small industrial and agricultural towns and rural unincorporated areas.[3] With respect to income, the distribution was reasonably similar to the estimated distribution of the general population of the United States at the time of the survey.

Each family was visited at intervals of 2 to 4 months for a period long enough to obtain a sickness record for 12 consecutive months. On the first call a record was made of the number of members of the household, together with sex, age, and other facts about each person. On succeeding visits the canvasser recorded all illness that had occurred since the preceding call, with such pertinent facts about each case as the date of onset, the total duration of symptoms, the days of disability, and the days of confinement to bed. Data about cases that were still sick at the preceding visit were brought up to date and when completed the termination was entered.

Definition of illness as recorded in survey.—An illness, for the purpose of this study, was defined as any symptom, disorder, or affection which

[2] The 18 States sampled and the number of canvassed families were as follows: California (800), Colorado (386), Connecticut (100), District of Columbia (99), Georgia (544), Illinois (463), Indiana (404), Kansas (301), Massachusetts (287), Michigan (329), Minnesota (224), New York (1,710), Ohio (1,148), Tennessee (212), Virginia (412), Washington (551), West Virginia (318), Wisconsin (290). Further details about the distribution of the canvassed population are included in a preceding paper (*1*).

[3] Every community that was included in the study had either a local health department or some other organization employing a visiting nurse or both; therefore, the most rural areas with no organized community services are not represented.

persisted for 1 or more days or for which medical service [4] was received or medicine purchased. Illness included the results of both disease and injury. What was actually included as illness, however, was necessarily influenced not only by the informant's (usually the housewife's) conception of sickness, but also by her memory. With visits as infrequent as 2 to 4 months, it was inevitable that many of the nondisabling illnesses would be terminated and forgotten before the next visit of the enumerator. However, if the record includes most of the real illnesses and excludes only the minor disorders, it may be as useful as a more complete one.

No special inquiry was made about mental defectives at home or about persons away from the family throughout the year in such resident institutions as hospitals for the insane, mental defective, or tuberculous; however, a few such cases were recorded.[5] Physical impairments such as blindness and lost and impaired limbs were not included as sickness unless the defect was treated or otherwise involved some status other than the mere presence of an impairment. These various factors made for a minimum of recorded cases that were sick, disabling, in bed, or in a hospital throughout the year of the study.[6] While such cases are always rare as compared with short illnesses, they have an important influence on the days of sickness, of disability, and of time in bed per case.[7]

Classification of causes of illness.—In the present study of 8,758 households visited periodically, the diagnosis as reported by the family informant was submitted to the attending physician for confirmation or correction and his diagnosis substituted for the one

[4] Exclusive of dental services, eye refractions, immunizations, and health examinations rendered when no symptoms were present.

[5] A total of 16 cases of all diagnoses were recorded as being in a hospital throughout the year of the study; 6 of these cases were nervous and mental, 8 tuberculous, and 2 orthopedic, of which 1 was of congenital origin and was complicated by mental defect.

[6] The numbers of illnesses from all causes (sole or primary diagnosis) that lasted throughout the study year were:

Type of case and of duration	Total cases of each type	Cases with 350 or more days of duration of the specified type during year	
		Number	Percent
All cases	32,752	1,551	4.74
Nondisabling	12,865	1,018	7.91
Disabling	19,887	116	.58
Bed	16,728	42	.25

The total of 1,551 cases with symptoms lasting 350 or more days during the year includes 417 cases that were disabling from 1 to 349 days.

Of the cases with diagnoses that are commonly considered as chronic, more than one-fourth were reported as sick 350 or more days during the year; and of the nondisabling cases of this "chronic" category, about one-third were so recorded. The cases that were disabling for 350 or more days constituted only about 5 percent of all "chronic" cases that disabled for 1 or more days; and the cases in bed for 350 or more days constituted only about 2 percent of all "chronic" cases that were in bed for 1 or more days.

[7] For a discussion of institutional cases and days in relation to sickness surveys, see preceding paper (*14*).

reported by the family. While not all cases were attended and reports could not be obtained from all attending physicians, the replies indicated that the housewife usually reported with reasonable accuracy the diagnosis which the physician had given to the family.[8]

Considering an illness in the sense of a continuous period of sickness, only 4.3 percent were designated as due to more than one cause. In general, the more important or more serious cause was assigned as primary, except where a disease like pneumonia is commonly recognized as following measles or influenza, in which case the antecedent condition was taken as primary.[9] In this series of papers, illness rates for all causes and for broad disease groups are based on sole or primary diagnoses only, but in computing the incidence of specific diseases, such as pneumonia, appendicitis, and whooping cough, all cases with the given diagnosis are counted whether it was the sole, primary, or contributory cause of the illness However, it was found that the average duration per case of a given disease was almost always higher when there was a complicating diagnosis. Therefore, average days per case are computed in this paper for: (*a*) Illnesses with only one cause, designated as "sole diagnosis," and (*b*) illnesses with two or more diagnoses, designated as "complicated." This latter category includes all illnesses in which a given diagnosis was present, whether it was coded as the primary or as a contributory cause of the illness.

Methods of recording and computing duration.—The duration refers in all instances to the days *within the 12-month study period;* thus the maximum duration of any type is 365 days. In computing average days sick, disabled, or in bed per case, both complete and incomplete cases are included as cases but the days refer to those within the study year only. The incomplete cases (those with prior onset and those still sick at the last report) usually average considerably longer durations than the complete cases and an average which excluded them from the computation would be biased toward shorter cases. The only date of onset recorded was the onset of symptoms (nondisabling or disabling) of this attack. Thus for disabling and bed cases, prior onset does not necessarily mean that disability or confinement to bed began prior to the study year. Considering all diagnoses, 7 percent were recorded with onset of symptoms prior to the study year. The other 93 percent were recorded with the onset within the year;

[8] See comparison of diagnoses reported by families and by physicians in the Health Survey of 1935–36 (*18*, table 2)

[9] Further details on the method of classifying the causes of illness are included in the first report in the series (*1*).

however, this would not always mean, even for a chronic disease, that the individual never suffered previous attacks of symptoms of the disease.

For diagnosis categories commonly considered as consisting almost exclusively of chronic diseases, 33 percent had a prior onset, as compared with 3 percent for other (acute) cases. A preceding paper shows for detailed diagnoses the number of cases with prior onset (*1*). The percentages of cases still sick at the last report are of the same order of magnitude as those for prior onset.[10]

Durations usually represent specific attacks, even for chronic diseases. For example, a cardiac patient may have had the disease for 5 years, may have entered the study in reasonable health for such a person, and have had within the period an attack which lasted 2 weeks. Such a case was tabulated as having a duration of 2 weeks rather than a duration throughout the year. There were relatively

[10] The percentage of cases with onset of symptoms prior to the study year and the percentage that were incomplete for any reason varied with type of case and for sole, primary, and contributory diagnoses. In the following table "chronic" cases refer to diagnosis categories commonly considered as consisting almost exclusively of chronic diseases.

Type of case	Sole, primary, and contributory diagnoses			Sole and primary diagnoses			Contributory diagnoses		
	Total	Acute	Chronic	Total	Acute	Chronic	Total	Acute	Chronic
	Percentage of cases with onset of symptoms (nondisabling or disabling) prior to study year								
Total	7.1	3.2	32.9	6.6	2.9	32.5	15.2	9.5	36.7
Nondisabling	10.5	4.8	37.6	10.0	4.6	36.7	27.0	13.4	51.0
Disabling	5.0	2.2	28.2	4.4	2.0	27.7	15.2	8.2	30.9
Bed	4.8	2.1	27.5	4.2	1.8	26.9	15.0	7.8	30.8
	Percentage of cases with incomplete durations because of prior onset, still sick on last report, or both								
Total	9.7	4.6	43.2	9.0	4.3	42.6	25.1	14.0	48.5
Nondisabling	13.9	6.7	48.5	13.2	6.4	47.4	35.9	19.0	65.7
Disabling	7.1	3.4	37.8	6.3	3.0	37.2	21.3	12.3	41.4
Bed	6.9	3.2	36.9	6.0	2.8	36.2	20.8	12.0	40.3

Prior onset does not necessarily mean that onset of disability or confinement to bed was prior to the study year, and still sick does not necessarily mean still disabled or in bed. Last report on case is not always at end of year, some cases were incomplete because the record was left unfinished rather than because the patient was still sick at the end of the study.

TABLE 1.—*Mean durations of various types within the year of observation*[1] *for illnesses classified into broad groups of causes—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31 (38,544 person-years of experience)*

Disease group and whether sole cause or primary of 2 or more diagnoses[2]	Total case rate per 1,000 population during year: Adjusted[3]	Total case rate per 1,000 population during year: Crude	Total number of cases	Bed duration: Number of cases in bed for 1 or more days	Bed duration: Percent of cases in bed for 1 or more days	Bed duration: Mean days in bed: Per total case	Bed duration: Mean days in bed: Per bed case	Disabling duration: Number of cases disabling for 1 or more days	Disabling duration: Percent of cases disabling for 1 or more days	Disabling duration: Mean days of disability[4]: Per total case	Disabling duration: Mean days of disability[4]: Per disabling case	Total duration of symptoms (mean days sick per case)	Number of disabling cases with known number of days of disability
All causes:													
Sole or primary	822.5	849.7	32,752	16,728	51.1	4.3	8.5	10,887	60.7	8.7	14.3	31	14,310
Sole	-----	----	31,344	15,810	50.4	3.9	7.8	18,853	60.1	7.9	13.2	39	13,508
Complicated	-----	-----	2,942	1,938	65.9	14.0	22.1	2,174	73.9	26.2	35.4	76	1,489
Minor respiratory diseases (11 pt. 97, 98, 99, pt. 107, pt. 109):													
Sole or primary	277.5	294.1	11,336	6,691	59.0	2.6	4.4	7,587	66.9	4.6	6.9	10	5,414
Sole	-----	-----	10,8[illegible]5	6,306	59.0	2.5	4.3	7,240	66.8	4.4	6.6	10	5,188
Complicated	-----	-----	618	385	62.3	5.0	8.0	447	72.3	10.0	13.9	23	284
Other respiratory diseases (31, pt 97, 100–106, pt. 107, pt. 109):													
Sole or primary	51.0	54.3	2,091	1,508	72.1	9.2	12.8	1,607	76.9	17.0	22.1	45	949
Sole	-----	----	1,081	1,412	71.3	8.6	12.1	1,510	76.2	16.0	21.0	44	880
Complicated	-----	-----	271	237	86.5	22.3	25.8	246	89.8	37.1	41.3	74	162
Minor digestive diseases (15, pt 16, 112–114):													
Sole or primary	57.1	60.3	2,323	1,139	49.0	1.7	3.5	1,303	56.1	3.4	6.1	17	769
Sole	-----	-----	2,253	1,109	49.2	1.7	3.4	1,260	56.3	3.1	5.5	15	749
Complicated	-----	-----	184	89	48.4	4.3	8.9	108	58.7	10.8	18.5	56	67
Other digestive diseases (pt. 108, 110, 111, 115–127):													
Sole or primary	28.9	26.7	1,031	621	60.2	8.5	14.1	679	65.9	15.4	23.4	63	509
Sole	-----	-----	944	560	59.3	6.7	11.3	612	64.8	12.9	19.9	59	513
Complicated	-----	-----	160	114	71.3	24.2	34.0	120	75.0	38.9	51.8	95	94
Communicable diseases (1–10, 12–14, pt. 16, 17–30, 32–42):													
Sole or primary	71.4	95.2	3,671	2,241	61.0	4.6	7.5	2,826	77.0	13.8	18.0	23	1,889
Sole	-----	-----	3,537	2,135	60.4	4.4	7.2	2,708	76.6	13.3	17.4	22	1,821
Complicated	-----	-----	190	151	79.5	12.6	15.8	171	90.0	30.9	34.3	49	103

[1] Cases with onset prior to the study and those still sick on the last visit are included along with completed cases, but only for the days of the respective kinds of duration that came within the year of observation. Average durations tend to be greater for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit. Prior onset of illness does not necessarily mean prior onset of disability or of confinement to bed.

[2] A case is considered as complicated if another diagnosis is reported as occurring simultaneously with or as overlapping the period of sickness from the diagnosis listed regardless of which diagnosis was classified as the primary cause of the illness. The complication may have a definite relationship to the other diagnosis (as in measles and pneumonia), or be apparently unrelated (as in measles and chickenpox). The numbers in parentheses following the names of the diseases are those used in the International List of the Causes of Death, 1920 revision.

[3] Adjusted by the *direct* method to the age distribution of the white population of the death registration States in 1930 as a standard population; this population is given for specific ages in table 1 of a preceding paper (4). The adjustment method involves the weighting of the age specific rates for the canvassed population according to the age distribution of the standard population. The details of the process are given under the heading of "corrected death rates" in Pearl *(17)*, pp. 269–271.

[4] Disability refers to inability to work, attend school, care for home, or pursue other usual activities, regardless of employment status and age.

In computing mean days of disability, disabling cases with an unknown number of days of disability were put in at an average based on cases of the same diagnosis group with known days of disability, exclusive of the few cases that disabled throughout the year of observation. The numbers of disabling cases with unknown days of disability were large; the numbers of disabling cases with known days of disability are shown in the last column of the table.

Bed cases with an unknown number of days in bed and cases with an unknown total duration of symptoms were handled in the same way, but the numbers of such cases were small.

Although the days of disability were coded in only broad class intervals, a hand tabulation was made for all the longer cases and their exact value used in computing the mean. Duration in bed was entered in days and weeks up to the whole year of observation and the means computed from summated days rather than from the distribution shown in table 4. Total duration was coded in broad class intervals but correct means for the broader classes were determined by a hand tabulation of a considerable sample of the cases with longer durations.

TABLE 1.—*Mean durations of various types within the year of observation for illnesses classified into broad groups of causes—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31 (38,544 person-years of experience*—Continued

Disease group and whether sole cause or primary of 2 or more diagnoses	Total case rate per 1,000 population during year		Total number of cases	Bed duration				Disabling duration				Total duration of symptoms (mean days sick per case)	Number of disabling cases with known number of days of disability
	Adjusted	Crude		Number of cases in bed for 1 or more days	Percent of cases in bed for 1 or more days	Mean days in bed: Per total case	Mean days in bed: Per bed case	Number of cases disabling for 1 or more days	Percent of cases disabling for 1 or more days	Mean days of disability: Per total case	Mean days of disability: Per disabling case		
Ear and mastoid diseases (86):													
Sole or primary	16.3	18.8	723	281	38.9	2.4	6.2	360	50.6	7.0	13.8	25	222
Sole	----	----	695	264	38.0	2.3	6.2	345	49.6	6.2	12.5	24	209
Complicated	----	----	212	139	65.6	6.3	9.6	154	72.6	12.6	17.3	26	87
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis (70–73, 76–81, 84):													
Sole or primary	14.1	12.9	499	201	40.3	13.8	34.3	241	48.3	23.6	48.9	96	173
Sole	----	----	478	185	38.7	12.2	31.5	225	47.1	21.9	46.6	95	163
Complicated	----	----	78	52	66.7	40.3	60.5	55	70.5	55.4	78.6	129	34
Rheumatism and related diseases (51, 52, 82, pt. 158):													
Sole or primary	25.8	20.7	797	326	40.9	5.2	12.7	403	50.6	10.3	20.3	70	349
Sole	----	----	769	309	40.2	4.9	12.1	384	49.9	9.3	18.6	67	333
Complicated	----	----	106	59	55.7	14.3	25.7	67	63.2	36.7	58.1	131	51
Degenerative diseases (43–50, 57, 74, 75, 83, 87–92, pt. 93, pt. 96, 128, 129, 130, pt. 131, 132, pt. 133, 135):													
Sole or primary	43.0	31.6	1,218	541	44.4	12.3	27.8	633	52.0	23.1	44.4	119	487
Sole	----	----	1,020	410	40.2	9.6	23.8	485	47.5	17.7	37.3	109	383
Complicated	----	----	410	284	69.3	25.5	36.9	320	78.0	43.6	55.8	148	235
Skin diseases (151–154, pt. 205):													
Sole or primary	33.2	34.8	1,341	176	13.1	1.0	7.4	381	28.4	4.2	14.7	39	316
Sole	----	----	1,329	173	13.0	1.0	7.3	374	28.1	4.1	14.7	39	309
Complicated	----	----	66	20	43.9	8.5	19.3	44	66.7	19.7	29.6	75	32
Female genital and puerperal diagnoses (137–150):													
Sole or primary	[5]82.3	[5]78.5	1,540	1,217	79.0	9.3	11.7	1,241	80.6	13.9	17.2	43	1,103
Sole	----	----	1,445	1,141	79.0	8.7	11.0	1,165	80.6	12.6	15.6	38	1,033
Complicated	----	----	197	153	77.7	18.0	23.1	154	78.2	33.0	42.2	115	140
Accidental injuries (pt. 85, 165–203):													
Sole or primary	73.7	74.7	2,880	866	30.1	2.9	9.8	1,387	48.2	7.8	16.3	19	1,170
Sole	----	----	2,837	833	29.4	2.7	9.2	1,349	47.6	7.5	15.8	18	1,143
Complicated	----	----	52	38	73.1	21.1	28.8	46	88.5	30.3	34.3	51	34
All other diseases (53–56, 58–69, 85, pt. 93, 94, 95, pt. 96, pt. 108, pt. 131, pt. 133, 134, 136, 155–157, pt. 158, 159–164, 204, 205):													
Sole or primary	85.8	85.7	3,302	920	27.9	3.6	12.9	1,233	37.3	5.6	15.1	53	900
Sole	----	----	3,221	883	27.4	3.3	11.9	1,188	36.9	5.3	14.8	51	865
Complicated	----	----	395	208	52.7	12.5	23.8	242	61.3	21.5	35.0	83	166

[5] Rates for female genital and puerperal diagnoses in the table are expressed as cases per *1,000 females*; rates per 1,000 total population are: Adjusted, 44.8; crude, 30.9.

few instances of second or later attacks [11] of the same disease within the study year. This is partly explained by the following: (*a*) Visits made at intervals of 2 to 4 months miss many of the mild nondisabling respiratory attacks that are given so frequently in weekly and bimonthly (*15*) reports, (*b*) many attacks of nondisabling chronic diseases in this study represent year-long durations of symptoms, (*c*) an attack may not represent a continuous period of disability; if symptoms were continuous it was counted as one attack even when disability was intermittent.

Bed cases with an unknown number of days in bed were put in at an average based on bed cases of the same diagnosis; disability and total duration were handled in a similar way. The numbers of cases with unknown durations were small except for disability among children and others not gainfully employed. In a few instances it was unknown whether the patient was confined to bed and such cases were counted as not in bed; similarly, cases in which it was unknown whether the patient was disabled were counted as not disabled. A day in a hospital was always counted as a day in bed regardless of whether the patient actually remained in bed. Mean durations for days in bed were computed from a tabulation of durations in actual days up to 45 and in weeks throughout the remainder of the 12 months. Mean durations for days of disability were computed from grouped data with a supplementary hand tabulation of actual durations of all cases in the broader class intervals. Mean total durations of symptoms were computed from grouped data, but centering points or averages for the broader class intervals were determined by a tabulation of a sample of cases in those classes. In all instances the cases with a full year's duration were used as a separate class and included at their actual value in computing average durations.

II. MEAN DURATIONS OF VARIOUS TYPES FOR ILLNESSES FROM SPECIFIC CAUSES

A considerable mass of data has been published on such epidemiological facts as the age incidence of various diseases. The important epidemiological facts about the durations of illnesses have not received equal attention. Table 1 shows average durations for each of the

[11] Out of a total of 34,287 diagnoses (sole, primary, or contributory), 1,470, or 4.3 percent, were second or later attacks of the same disease in the same individual. These 1,470 second or later attacks represent 1,323 instances of individuals having 2 or more attacks of the same disease during the year, or a total of 2,793 attacks for such persons; the other 31,494 attacks represent the only case of the given diagnosis for an individual during the year. Many of these second or later attacks were of the minor respiratory diseases; if the computation is limited to diagnosis categories commonly considered as chronic diseases, only about 2 percent of the "chronic" diagnoses represent second or later attacks of the same disease in the same individual within the study year. Thus it is seen that the method adopted in this study of counting *attacks* of chronic diseases has not materially changed the picture that would have been obtained by consolidating into a single chronic case all of an individual's attacks of the same chronic diagnosis.

TABLE 2.—*Mean durations of various types within the year of observation [1] for illnesses from specific [2] causes—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31 (38,544 person-years of experience)*

Disease and whether sole diagnosis or complicated by another disease [3]	Total case rate per 1,000 population during year (sole, primary or contributory): Adjusted [4]	Total case rate per 1,000 population during year (sole, primary or contributory): Crude	Total number of cases	Bed duration: Number of cases in bed for 1 or more days	Bed duration: Percent of cases in bed for 1 or more days	Bed duration: Mean days in bed: Per total case	Bed duration: Mean days in bed: Per bed case	Disabling duration: Number of cases disabling for 1 or more days	Disabling duration: Percent of cases disabling for 1 or more days	Disabling duration: Mean days of disability [5]: Per total case	Disabling duration: Mean days of disability [5]: Per disabling case	Total duration of symptoms (mean days sick per case)	Number of disabling cases with known number of days of disability
Minor respiratory diseases:													
Influenza and grippe (11)	84.06	86.1	3,320										
Sole			3,152	2,668	81.6	4.3	5.1	2,790	88.8	7.3	8.2	10	2,063
Complicated			168	142	84.5	8.9	10.5	151	89.9	16.6	18.4	32	102
Bronchitis and chest colds (99)	45.64	48.9	1,883										
Sole			1,801	1,066	59.2	2.6	4.3	1,190	66.1	4.6	7.0	12	771
Complicated			82	48	58.5	5.4	9.2	57	69.5	10.3	14.8	35	27
Coryza and colds, unqualified (pt. 97, pt. 107)	100.14	107.3	4,131										
Sole			3,903	1,532	39.2	1.3	2.9	1,910	40.7	2.3	4.5	8	1,390
Complicated			228	102	44.7	1.8	4.0	133	58.3	5.8	10.0	13	89
Cough (pt. 107)	2.26	2.7	101										
Sole			100	23	23.0	.9	4.1	37	37.0	3.7	10.1	10	28
Tonsillitis (pt. 109)	20.48	23.3	897										
Sole			841	640	76.1	2.8	3.7	699	83.1	4.8	5.8	7	506
Complicated			56	45	80.1	6.7	8.4	46	82.1	11.5	14.0	18	26
Quinsy (pt. 109)	1.96	1.8	70										
Sole			66	50	75.8	5.0	6.6	56	84.8	10.0	11.8	13	52
Sore throat (pt. 109)	16.68	17.0	656										
Sole			621	231	37.2	1.3	3.5	305	49.1	2.1	5.0	9	239
Complicated			35	18	51.4	2.7	5.3	27	77.1	6.8	8.9	12	20
Other pharynx and tonsil affections, except tonsillectomy (pt. 109)	4.11	4.5	173										
Sole			138	76	55.1	2.8	5.2	84	60.9	5.1	8.1	20	67
Complicated			35	19	54.3	5.7	10.6	21	60.0	8.7	14.5	33	11
Laryngitis (pt. 98)	2.96	2.8	109										
Sole			104	49	47.1	1.7	3.7	56	53.8	3.3	6.1	13	41
Croup (pt. 98)	1.92	2.9	112										
Sole			110	61	55.5	1.6	3.0	73	66.4	3.1	4.7	6	32
Other respiratory diseases:													
Tonsillectomy and adenoidectomy (pt. 109)	17.97	21.8	841										
Sole			791	770	97.3	3.1	3.2	774	97.9	8.1	8.3	8	371
Complicated			50	48	96.0	12.9	13.4	49	98.0	27.3	27.9	42	34
Pneumonia, all forms (100, 101)	7.31	8.2	316										
Sole			239	239	100.0	15.5	15.5	239	100.0	24.0	24.0	24	118
Complicated			77	77	100.0	31.8	31.8	77	100.0	44.0	44.0	45	40
Sinusitis (pt. 97)	10.85	10.3	395										
Sole			340	116	31.1	2.0	5.8	156	45.9	5.1	11.1	46	136
Complicated			55	39	70.9	10.7	15.1	42	76.1	21.6	28.3	91	34
Vincent's angina (pt. 109)	1.14	1.0	40										
Sole			38	10	26.3	1.5	5.8	14	36.8	3.9	10.6	50	11
Asthma (105)	4.19	3.9	150										
Sole			131	57	43.5	4.0	9.2	72	55.0	8.3	15.1	116	56
Complicated			19	14	73.7	28.5	38.7	15	78.9	(7)	(7)	131	9
Hay fever (pt. 107)	2.08	2.0	76										
Sole			75	6	8.0	(6)	(6)	8	10.7	(7)	(7)	73	8
Pleurisy (102)	3.48	3.0	114										
Sole			85	67	78.8	7.2	9.1	76	89.4	12.6	14.1	20	66
Complicated			29	27	93.1	22.4	24.0	28	96.6	32.9	34.0	50	25
Respiratory tuberculosis (pt. 31)	2.91	2.7	105										
Sole			92	60	65.2	88.2	135.2	68	73.9	142.4	192.7	217	55
Complicated			13	10	76.9	69.2	90.0	10	76.9	(7)	(7)	241	7
Suspected respiratory tuberculosis (pt. 31)	1.16	1.2	47										
Sole			39	12	30.8	(6)	(6)	15	38.5	22.0	57.2	148	12

See footnotes at end of table.

TABLE 2.—*Mean durations of various types within the year of observation for illnesses from specific causes—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31 (38,544 person-years of experience)*—Continued

Disease and whether sole diagnosis or complicated by another disease	Total case rate per 1,000 population during year (sole, primary or contributory)		Total number of cases	Bed duration				Disabling duration				Total duration of symptoms (mean days sick per case)	Number of disabling cases with known number of days of disability
	Adjusted	Crude		Number of cases in bed for 1 or more days	Percent of cases in bed for 1 or more days	Mean days in bed: Per total case	Mean days in bed: Per bed case	Number of cases disabling for 1 or more days	Percent of cases disabling for 1 or more days	Mean days of disability: Per total case	Mean days of disability: Per disabling case		
Minor digestive diseases:													
Indigestion, upset stomach, and nausea (pt. 112)	31.00	31.8	1,220										
Sole			1,135	546	48.1	1.3	2.6	642	56.6	3.0	5.2	11	407
Complicated			91	39	42.9	3.8	8.9	48	52.7	11.2	21.3	37	37
Biliousness (pt. 112)	3.78	3.8	145										
Sole			138	91	65.9	1.5	2.3	101	73.2	2.6	3.5	6	77
Other and ill-defined stomach diseases (pt. 112)	6.23	6.2	238										
Sole			208	64	30.8	2.5	8.0	88	42.3	4.7	11.0	53	53
Complicated			30	10	33.3	[6]	[6]	15	50.0	11.5	23.1	147	10
Diarrhea and enteritis (15, pt. 16, 113, 114)	18.92	21.5	829										
Sole			773	408	52.8	2.1	3.9	440	56.9	3.9	6.8	13	214
Complicated			56	34	60.7	6.1	10.1	38	67.9	12.3	18.2	44	17
Other digestive diseases:													
Ulcers of stomach and duodenum (111)	2.27	2.0	76										
Sole			70	32	45.7	6.9	15.2	41	58.6	19.1	32.6	154	38
Intestinal parasites, except hookworm (116)	.79	1.1	43										
Sole			41	8	19.5	[6]	[6]	11	26.8	[7]	[7]	32	7
Appendicitis (117)	9.62	9.1	352										
Sole			291	250	85.9	10.5	12.2	257	88.3	19.3	21.9	20	227
Complicated			61	56	91.8	35.9	39.1	56	91.8	56.0	61.0	88	46
Hernia, intestinal obstruction (118)	3.11	2.7	106										
Sole			89	53	59.6	12.2	20.5	57	64.0	22.9	35.8	107	42
Complicated			17	12	70.6	18.7	26.5	12	70.6	36.7	52.0	110	11
Constipation (pt. 119)	2.61	2.4	92										
Sole			82	13	15.9	.3	2.1	18	22.0	1.3	5.8	102	11
Biliary calculi, cholecystitis (123, pt. 124)	6.10	4.8	185										
Sole			162	110	67.9	7.0	10.3	115	71.0	11.6	16.3	59	97
Complicated			23	14	60.9	19.6	32.1	16	69.6	46.7	67.1	140	12
Other and ill-defined liver diseases (pt. 124)	2.28	2.1	79										
Sole			65	26	40.0	1.3	4.4	36	55.4	3.7	6.6	46	29
Diseases of the mouth except teeth and gums (pt. 108)	1.30	1.6	61										
Sole			55	11	20.0	.8	3.9	14	25.5	1.9	7.6	28	11
Communicable diseases:													
Measles (7)	16.90	24.4	940										
Sole			887	802	90.4	4.9	5.4	827	93.2	9.7	10.4	10	429
Complicated			53	43	81.1	9.5	11.8	46	86.8	22.2	25.5	35	23
German measles (pt. 25)	1.33	1.6	61										
Sole			58	32	55.2	1.6	2.8	47	81.0	4.0	5.0	6	42
Whooping cough (9)	12.87	19.2	739										
Sole			708	117	16.5	.9	5.7	325	45.9	13.7	29.9	39	204
Complicated			31	22	71.0	9.4	13.3	26	83.9	31.3	37.3	55	10
Chickenpox (pt. 25)	10.65	15.5	596										
Sole			578	309	53.5	2.0	3.7	444	76.8	8.7	11.4	13	316
Complicated			18	16	88.9	7.7	8.6	18	100.0	24.5	24.5	25	14
Mumps (13)	9.38	12.1	466										
Sole			446	275	61.7	3.1	5.1	380	85.2	8.9	10.4	12	308
Complicated			20	17	85.0	6.4	7.5	20	100.0	[7]	[7]	15	9
Scarlet fever (8)	4.47	6.0	232										
Sole			215	200	93.0	13.3	14.2	209	97.2	23.8	24.4	31	152
Complicated			15	14	93.3	25.0	26.8	15	100.0	28.3	28.3	29	11

See footnotes at end of table.

TABLE 2.—*Mean durations of various types within the year of observation for illnesses from specific causes—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31 (38,544 person-years of experience)*—Continued

Disease and whether sole diagnosis or complicated by another disease	Total case rate per 1,000 population during year (sole, primary or contributory)		Total number of cases	Bed duration				Disabling duration				Total duration of symptoms (mean days sick per case)	Number of disabling cases with known number of days of disability
	Adjusted	Crude		Number of cases in bed for 1 or more days	Percent of cases in bed for 1 or more days	Mean days in bed: Per total case	Mean days in bed: Per bed case	Number of cases disabling for 1 or more days	Percent of cases disabling for 1 or more days	Mean days of disability: Per total case	Mean days of disability: Per disabling case		
Communicable diseases—Continued													
Diphtheria (10)	1.45	1.8	70										
Sole			68	67	98.5	11.5	11.7	67	98.5	18.2	18.5	19	45
Smallpox (6)	.40	.4	17										
Sole			17	14	82.4	5.6	6.8	14	82.4	15.3	18.6	19	11
Typhoid fever (1)	.37	.4	15										
Sole			14	14	100.0	28.1	28.1	14	100.0	36.5	30.5	42	10
Malaria (5)	3.31	3.3	129										
Sole			118	95	80.5	4.5	5.6	97	82.2	6.7	8.2	11	76
Comulicated			11	10	90.9	13.5	14.9	11	100.0	24.5	24.5	41	10
Erysipelas (21)	.86	.7	26										
Sole			25	21	84.0	8.1	9.7	22	88.0	17.3	19.6	24	19
Tuberculosis, nonrespiratory (32-37)	.67	.8	30										
Sole			23	14	60.9	71.4	117.4	17	73.9	112.0	151.5	235	11
Local and other infections not specified as accidental (41)	5.99	6.1	233										
Sole			210	83	37.9	2.3	6.1	120	57.5	6.5	11.4	19	109
Complicated			14	10	71.4	30.9	43.2	13	92.9	(7)	(7)	67	9
Smallpox vaccination (pt. 42)	1.58	2.0	76										
Sole			76	51	67.1	1.8	2.7	72	94.7	3.6	3.7	9	57
Ear and mastoid diseases:													
Earache (pt. 86)	3.22	4.0	154										
Sole			115	31	27.0	.6	2.2	51	44.3	1.6	3.6	8	31
Complicated			39	16	41.0	2.1	5.1	22	56.4	4.3	7.6	11	14
Otitis media (pt. 86)	10.52	13.4	518										
Sole			390	177	45.4	2.6	5.6	225	57.7	5.6	9.7	19	135
Complicated			128	89	69.5	6.7	9.6	95	74.2	14.4	19.5	30	47
Other ear diseases (pt. 86)	5.01	4.7	183										
Sole			150	20	13.3	.6	4.3	33	22.0	1.7	7.5	37	21
Complicated			33	23	69.7	3.5	5.0	25	75.8	6.7	8.9	17	17
Diseases of mastoid process (pt. 86)	1.14	1.3	52										
Sole			40	36	90.0	11.7	13.1	36	90.0	28.7	31.9	63	16
Complicated			12	12	100.0	23.9	23.9	12	100.0	(7)	(7)	56	9
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis:													
Nervousness (pt. 84)	7.39	6.5	249										
Sole			220	54	21.5	1.6	6.7	67	30.5	6.1	19.9	66	61
Complicated			29	12	41.4	6.1	14.8	14	48.3	6.7	13.8	132	11
Neurasthenia, nervous breakdown (pt. 84)	3.70	3.1	118										
Sole			103	55	53.4	6.7	12.5	67	65.0	29.6	45.5	88	56
Complicated			15	11	73.3	12.2	16.6	12	80.0	(7)	(7)	115	8
Convulsions, unqualified (79, 80)	.84	1.3	48										
Sole			40	29	72.5	4.2	5.8	31	77.5	(7)	(7)	16	8
Other nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis (70–73, 76–78, 81, pt. 84)	3.76	3.7	141										
Sole			115	47	40.9	42.4	103.8	60	52.2	54.1	103.7	183	89
Complicated			26	23	88.5	107.4	121.4	23	88.5	146.3	165.4	215	14

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Disease and whether sole diagnosis or complicated by another disease	Total case rate per 1,000 population during year (sole, primary or contributory): Adjusted	Total case rate per 1,000 population during year (sole, primary or contributory): Crude	Total number of cases	Bed duration: Number of cases in bed for 1 or more days	Bed duration: Percent of cases in bed for 1 or more days	Bed duration: Mean days in bed: Per total case	Bed duration: Mean days in bed: Per bed case	Disabling duration: Number of cases disabling for 1 or more days	Disabling duration: Percent of cases disabling for 1 or more days	Disabling duration: Mean days of disability: Per total case	Disabling duration: Mean days of disability: Per disabling case	Total duration of symptoms (mean days sick per case)	Number of disabling cases with known number of days of disability
Rheumatism and related diseases:													
Acute rheumatic fever (51)	1.12	1.0	38										
Sole			32	27	84.4	21.2	25.1	28	87.5	24.3	27.7	54	27
Chronic rheumatism and arthritis (pt. 52)	6.29	4.5	172										
Sole			141	50	35.5	9.9	27.9	62	44.0	20.8	47.3	190	51
Complicated			31	18	58.1	33.7	58.1	20	64.5	94.7	146.7	240	11
Rheumatism, unqualified (pt. 52)	7.13	5.9	229										
Sole			204	90	44.1	3.5	7.9	106	52.0	6.3	12.2	29	93
Complicated			25	15	60.0	6.7	11.2	17	68.0	17.3	25.4	50	13
Neuralgia and neuritis (82)	8.64	7.0	269										
Sole			235	77	32.8	2.6	8.0	102	43.4	6.2	14.2	58	84
Complicated			34	15	44.1	4.7	10.7	18	52.9	18.4	34.8	142	17
Lumbago (pt. 158)	4.18	3.3	126										
Sole			122	59	48.4	2.5	5.3	79	64.8	5.6	8.7	21	72
Myalgia and myositis (pt. 158)	1.13	1.1	41										
Sole			35	6	17.1	[6]	[6]	7	20.0	[7]	[7]	29	6
Degenerative diseases:													
Cancer, all sites (43–49)	2.15	1.3	52										
Sole			42	28	66.7	37.2	55.8	31	73.8	57.4	77.8	187	23
Benign tumors, except of female organs (50)	3.87	3.3	127										
Sole			114	28	24.6	2.3	9.4	39	34.2	4.0	11.6	43	30
Diabetes (57)	2.52	1.9	72										
Sole			57	22	38.6	14.0	36.4	23	40.4	21.4	53.0	253	19
Complicated			15	10	66.7	26.3	39.4	12	80.0	[7]	[7]	224	6
Diseases of the heart (87–90)	12.58	8.7	336										
Sole			205	103	50.2	10.2	20.2	121	59.0	26.0	45.1	148	95
Complicated			131	92	70.2	31.8	45.3	104	79.4	60.4	76.1	171	76
Arteriosclerosis and high blood pressure (pt. 91, pt. 96)	8.11	4.8	185										
Sole			111	35	31.5	5.9	18.7	37	33.3	8.0	24.1	100	25
Complicated			74	57	77.0	31.3	40.7	57	77.0	36.8	47.8	168	44
Cerebral hemorrhage and paralysis (74, 75)	2.79	1.7	65										
Sole			33	22	66.7	63.5	95.2	21	72.7	95.5	131.4	173	20
Complicated			32	27	84.4	29.7	35.1	29	90.6	68.6	75.7	126	22
Varicose veins or ulcer (pt 93)	1.91	1.3	51										
Sole			44	10	22.7	5.8	25.5	13	29.5	14.9	50.5	147	13
Nephritis, acute and chronic (128, 129)	3.03	2.1	80										
Sole			47	26	55.3	14.6	26.4	30	63.8	35.5	55.7	91	23
Complicated			33	28	84.8	37.9	44.7	29	87.9	43.7	49.7	111	22
Other and unspecified kidney diseases except pyelitis (pt. 131)	5.43	4.8	184										
Sole			140	50	35.7	2.7	7.6	64	45.7	8.1	17.6	50	50
Complicated			44	22	50.0	6.7	13.4	31	70.5	30.2	42.9	91	25
Cystitis, and calculi of urinary passages (132, pt. 133)	4.96	4.1	158										
Sole			134	60	44.8	2.3	5.1	72	53.7	5.6	10.4	46	63
Complicated			24	12	50.0	14.3	28.5	16	66.7	[7]	[7]	127	8

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Degenerative diseases—Con.													
Other diseases of bladder (pt. 133)	1.99	1.9	73										
Sole			64	12	18.7	2.2	11.9	16	25.0	1.0	3.9	71	11
Skin diseases:													
Furuncle (152)	8.33	8.3	319										
Sole			307	52	16.9	.9	5.1	98	31.9	3.6	11.3	21	85
Abscesses and ulcers (153, pt. 154)	3.32	3.3	127										
Sole			116	41	35.3	2.3	6.4	60	51.7	5.5	10.6	24	46
Impetigo (pt. 154)	2.83	3.7	144										
Sole			138	5	3.6	([6])	([6])	37	26.8	3.7	13.7	23	30
Urticaria, hives (pt. 154)	1.64	1.8	69										
Sole			62	19	30.6	1.0	3.4	21	33.9	2.1	6.2	16	18
Scabies (pt. 154)	2.42	2.9	111										
Sole			106	4	3.8	([6])	([6])	43	40.6	7.4	18.3	29	39
Eczema (pt. 154)	3.73	4.1	160										
Sole			154	9	5.8	([6])	([6])	26	16.9	2.6	15.3	111	16
Other and ill-defined skin diseases (151, pt. 154, pt. 205)	12.38	12.1	465										
Sole			446	43	9.6	.9	8.9	89	20.0	2.5	12.7	40	75
Female genital and puerperal diagnoses:													
Cysts and tumors of ovary and uterus (137, 139)	[8] 2.77	[8] 2.3	46										
Sole			33	25	75.8	13.0	17.2	25	75.8	27.3	36.1	112	23
Complicated			13	13	100.0	24.2	24.2	13	100.0	47.2	47.2	113	11
Salpingitis and pelvic abscess (138)	[8] 1.62	[8] 1.6	32										
Sole			17	12	70.6	20.1	28.5	12	70.6	26.9	38.1	95	12
Complicated			15	15	100.0	25.3	25.3	15	100.0	57.8	57.8	85	13
Menstrual disorders (140, pt. 141)	[8] 13.18	[8] 11.8	231										
Sole			212	103	48.6	2.8	5.7	114	53.8	4.2	7.9	46	105
Other and ill-defined nonvenereal diseases of female organs, including chronic results of childbirth (pt. 141, 142, pt. 145, pt. 149)	[8] 16.05	[8] 16.1	322										
Sole			242	91	37.6	4.3	11.5	102	42.1	8.8	21.0	104	79
Complicated			80	48	60.0	13.2	22.0	48	60.0	23.4	39.0	153	45
Acute complications of pregnancy and childbirth (pt. 143, 144, pt. 145, 146-148, pt. 149)	[8] 3.25	[8] 3.2	63										
Sole			37	23	62.2	5.2	8.3	23	62.2	9.2	14.9	41	16
Complicated			26	24	92.3	22.7	24.6	24	92.3	45.0	48.7	72	21
Abortions, miscarriages, and stillbirths (pt. 143)	[8] 7.88	[8] 7.6	149										
Sole			136	133	97.8	10.3	10.5	135	99.3	16.0	16.1	21	121
Complicated			13	13	100.0	21.5	21.5	13	100.0	30.8	30.8	63	13
Live births (pt. 145, pt. 149)	[8] 40.17	[8] 38.8	761										
Sole			735	735	100.0	11.1	11.1	735	100.0	15.2	15.2	15	664
Complicated			26	26	100.0	24.8	24.8	26	100.0	34.6	34.6	40	24
Puerperal diseases of the breast (150)	[8] 2.06	[8] 1.0	38										
Sole			33	19	57.6	3.9	6.8	19	57.6	5.2	8.9	14	13

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				Number of cases in bed for 1 or more days	Percent of cases in bed for 1 or more days	Mean days in bed		Number of cases disabling for 1 or more days	Percent of cases disabling for 1 or more days	Mean days of disability			
	Adjusted	Crude				Per total case	Per bed case			Per total case	Per disabling case		
Accidental injuries:													
Poisoning by ivy, oak, and other plants (pt. 177)	2.38	2.5	96										
Sole			96	17	17.7	.6	3.6	34	35.4	1.7	4.9	10	28
Other accidental poisonings (175, 176, pt. 177)	2.93	3.1	119										
Sole			117	57	48.7	1.3	2.7	64	54.7	2.1	3.8	7	53
Automobile accidents (pt. 188)	5.23	5.0	191										
Sole			189	135	71.4	8.8	12.3	153	81.0	19.1	23.6	29	132
Accidental burns (179)	3.73	4.0	155										
Sole			152	33	21.7	1.4	6.5	58	38.2	4.0	10.6	13	45
Accidental injuries by cutting or piercing instruments (184)	6.84	7.6	293										
Sole			288	57	19.8	1.1	5.6	106	36.8	4.5	12.1	11	77
Accidental falls (185)	5.41	5.1	197										
Sole			191	62	32.5	2.9	9.1	90	47.1	8.4	17.8	17	70
Eye accidents (pt. 85, pt. 202)	2.95	3.1	118										
Sole			118	17	14.4	.8	5.7	38	32.2	4.3	13.3	10	82
Injuries by animals (189)	1.14	1.4	53										
Sole			51	8	15.7	(6)	(6)	13	25.5	1.6	6.5	7	11
All other accidents (165–174, 178, 180–183, 186, 187, pt. 188, 190–200, 201, pt. 202)	43.36	43.2	1667										
Sole			1635	447	27.3	2.8	10.2	793	48.5	8.1	16.7	21	695
Complicated			32	23	71.9	25.0	34.8	28	87.5	29.8	34.0	51	20
All other diseases:													
Anemia, all forms (58)	4.34	3.8	146										
Sole			114	23	20.2	2.7	13.4	32	28.1	9.0	32.1	138	28
Complicated			32	15	46.9	15.1	32.2	19	59.4	45.5	76.6	148	16
Diseases of thyroid gland (60)	3.81	3.5	134										
Sole			113	30	26.5	4.7	17.6	33	29.2	9.5	32.5	186	26
Acidosis (pt. 69)	1.61	1.8	70										
Sole			62	19	30.6	1.1	3.7	22	35.5	2.2	6.3	24	11
Sty (pt. 85)	1.49	1.7	64										
Sole			61	5	8.2	(6)	(6)	15	24.6	1.2	4.8	18	13
Conjunctivitis, pinkeye, sore eye (pt. 85)	4.66	5.4	208										
Sole			199	14	7.0	.3	3.6	92	46.2	2.9	6.4	12	81
Other eye diseases (pt. 85)	4.93	4.6	176										
Sole			159	25	15.7	2.2	14.1	47	29.6	7.5	25.3	79	41
Hemorrhoids (pt. 93)	3.20	2.9	111										
Sole			100	30	30.0	2.9	9.7	37	37.0	5.2	14.0	55	34
Diseases of lymphatic system (94)	4.60	6.0	232										
Sole			171	87	50.9	8.8	7.5	102	59.6	6.3	10.6	23	57
Complicated			61	38	62.3	6.5	10.4	45	73.8	8.5	11.5	15	29
Diseases of the teeth and gums (pt. 108)	10.67	11.6	448										
Sole			395	64	16.2	.9	5.5	101	25.6	1.3	5.1	15	67
Complicated			53	22	41.5	3.3	7.9	24	45.3	8.2	18.2	12	10
Pyelitis (pt. 131)	2.20	2.4	93										
Sole			81	45	55.6	6.4	11.5	51	63.0	10.2	16.2	45	41
Circumcision (pt. 136)	[9] 3.21	[9] 5.0	95										
Sole			80	58	72.5	2.6	3.5	60	75.0	(7)	(7)	7	3
Complicated			15	15	100.0	6.9	6.9	15	100.0	(7)	(7)	12	8
Diseases of bones and joints, except tuberculosis and rheumatism (155, 156)	2.30	2.1	82										
Sole			73	22	30.1	16.7	55.3	28	38.4	28.5	74.2	137	22

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All other diseases—Cont.													
Ill-defined orthopedic conditions and diseases of the organs of locomotion, except lumbago, myalgia and myositis (157, pt. 158, pt. 205)	4.96	4.7	183										
Sole			175	35	20.0	10.8	54.0	55	31.4	21.4	68.1	128	44
Congenital malformations and diseases of early infancy (159–163)	1.43	2.2	84										
Sole			69	36	52.2	17.0	33.6	38	55.1	(7)	(7)	98	6
Complicated			15	14	93.3	59.5	63.7	14	93.3	(7)	(7)	87	8
Foot trouble (pt. 205)	3.13	2.7	104										
Sole			104									11	
Headache (pt. 205)	6.95	6.3	213										
Sole			234	108	46.2	.9	1.9	132	56.4	1.4	2.5	21	122
Backache (pt. 205)	3.20	2.7	106										
Sole			102	21	20.6	.6	2.9	31	30.4	1.1	3.6	32	30
Debility, fatigue, exhaustion, malnutrition, loss of weight (pt. 205)	7.04	6.6	255										
Sole			233	48	20.6	3.2	15.7	63	27.0	4.1	15.0	57	56
Rash, unqualified (pt. 205)	2.18	2.7	106										
Sole			93	23	24.7	.8	3.3	29	31.2	1.5	4.9	13	15

[1] Cases with onset prior to the study and those still sick on the last visit are included along with completed cases, but only for the days of the respective kinds of duration that came within the year of observation. Average durations tend to be longer for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit. Prior onset of illness does not necessarily mean prior onset of disability or of confinement to bed.

[2] The table shows averages for all diagnoses that had 25 or more cases with known duration of symptoms, and for all other diagnoses that had 10 or more bed or 10 or more disabling cases with known days in bed or disabled, respectively. No average is computed for a given type of duration unless it is based on 10 or more cases with known days. No attempt is made to account for residual groups such as "other digestive" or "other communicable," only the fairly specific diagnoses being shown.

[3] A case is considered as complicated if another diagnosis is reported as occurring simultaneously with or as overlapping the period of sickness from the diagnosis listed regardless of which diagnosis was classified as the primary cause of the illness. The complication may have a definite relationship to the other diagnosis (as in measles and pneumonia), or be apparently unrelated (as in measles and chickenpox). The numbers in parentheses following the names of the diseases are those used in the International List of the Causes of Death, 1920 revision.

[4] Adjusted by the direct method to the age distribution of the white population of the death registration States in 1930 as a standard population; this population is given for specific ages in table 1 of a preceding paper (4). The adjustment method involves the weighting of the age specific rates for the canvassed population according to the age distribution of the standard population. The details of the process are given under the heading of "corrected death rates" in Pearl (17), pp. 260–271.

[5] Disability refers to inability to work, attend school, care for home, or pursue other usual activities, regardless of employment status and age.

In computing mean days of disability, disabling cases with an unknown number of days of disability were put in at an average based on cases of the same diagnosis with known days of disability, exclusive of the few cases that disabled throughout the year of observation. The numbers of disabling cases with unknown days of disability were large; the numbers of disabling cases with known days of disability are shown in the last column of the table.

Bed cases with an unknown number of days in bed and cases with an unknown total duration of symptoms were handled in the same way, but the numbers of such cases were small.

Although the days of disability were coded only in broad class intervals, a hand tabulation was made for all of the longer cases and their exact value used in computing the mean. Duration in bed was entered in days and weeks up to the whole year of observation and the means computed from summated days rather than from the distribution shown in table 4. Total duration was coded in broad class intervals but correct means for the broader classes were determined by a hand tabulation of a considerable sample of the cases with longer durations.

[6] Less than 10 bed cases with known number of days in bed—no mean computed.

[7] Less than 10 disabling cases with known number of days of disability—no mean computed.

[8] Rates for female genital and puerperal diagnoses are expressed as cases per 1,000 females.

[9] Rates for circumcision are expressed as cases per 1,000 males.

13 broad groups of causes used in the preceding paper (*14*); table 2 shows similar average durations for as many specific diagnoses as possible, each specific disease being classified under the broad category to which it belongs. Both tables show the several types of mean duration, i. e., days in bed per total case and per case in bed, days disabled per total case and per disabling case, and the average duration in days of symptoms of any kind. Along with the various mean durations are percentages of cases that were in bed and percentages that were disabling. Data are shown separately for illnesses of sole diagnosis and for those designated as "complicated," in which the given diagnosis was one of two or more causes. Table 2 includes all specific diagnoses with 25 or more cases of known total duration of symptoms and any others with 10 or more cases of known duration in bed or of known duration of disability.

The average duration in bed *within the study year* for the chronic diseases is not so large as one might expect. Considering all illnesses of sole diagnosis from degenerative diseases, 40 percent of the cases were in bed for 1 or more days, with an average of 9 6 days in bed per total case and 23.8 days per bed case. Complicated cases which may frequently represent the later stages of these diseases when various secondary ailments have developed show much higher averages, 25.5 days in bed per total case and 36.9 days in bed per bed case. Considering further the broad diagnosis groups shown in table 1, in terms of bed days per bed case for those with sole diagnosis, the nervous diseases have the longest average duration, 31.5 days,[12] and the minor digestive diseases the shortest average, 3.4 days, with minor respiratory diseases a close second with 4.3 bed days per case in bed. However, in bed days per total case (bed and nonbed), skin diseases (sole diagnosis) have the shortest average duration, 1.0 day per case. In terms of total duration of symptoms there are even greater differences between the diagnoses, the degenerative diseases (sole diagnosis), with an average duration of 109 days, being the longest, and minor respiratory diseases, with an average duration of 10 days, the shortest.

Figure 1 shows case incidence per 1,000 surveyed population for all cases of the given diagnosis, i. e., sole, primary, and contributory. Figure 2 shows mean days in bed *within the study year* per total case of the given diagnosis for illnesses with only one diagnosis. This particular average was selected from the several other types shown in table 2 because it best indicates the severity of the given disease, being affected by the proportion of the total cases that were in bed as well as the duration in bed for that fraction of the cases that went to bed.

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[12] The durations for nervous and mental diseases of 31 days in bed (including hospital) per bed case for sole diagnoses, and 60 days in bed for complicated cases both seem short for these diseases It must be remembered, however that these data include only a few institutional cases (hospitalized throughout the year) because no inquiry was made about persons more or less permanently away from the family. For further details, see preceding paper (*14*)

Cases of sole diagnosis were selected because their durations more nearly represent the given disease than a duration perhaps prolonged by some other more or less unrelated disease that occurred at the same time. For the acute diseases, the average duration within the year probably represents very nearly the whole duration of the case, because only a small percentage of the durations are incomplete. However, both of these selections tend to understate the durations of the chronic diseases because (*a*) the sole diagnosis cases may represent earlier stages before complications have developed, and (*b*) the duration within the one study year does not adequately represent the duration of the whole case which may extend over several years.

In figure 1 the specific diseases included in each broad group are arrayed according to the case incidence per 1,000; in figure 2 the arrangement within the broad groups is according to the mean duration but the order of the broad classes is the same. The minor respiratory and minor digestive diseases which loom large in frequency nearly all have fairly short durations in bed. The communicable diseases, however, have considerable frequencies and the majority of them have fairly long durations in bed also. The other (major) respiratory and digestive groups contain several diseases of long duration, particularly respiratory tuberculosis and pneumonia in the respiratory group, and hernia, appendicitis, cholecystitis, and ulcer of the stomach in diseases of the digestive tract. The degenerative diseases are not so frequent but mean durations are long, particularly for cerebral hemorrhage and the resulting paralysis, and for cancer, nephritis, diabetes, and heart diseases. The nervous diseases show long durations in bed; it must be recalled in this connection that a day in a hospital is always counted as a day in bed.

More detailed data are shown in table 2. No extended comment on this table is necessary, but a few things might be pointed out: Illnesses with only one diagnosis are almost invariably of shorter average duration than those with the same diagnosis but complicated by another disease. Although the complications are often trivial, they appear to add considerably to the duration of the illness. In some instances the second diagnosis is a true complication, such as measles and pneumonia, or heart disease and nephritis, but in others the simultaneous occurrence of the two diagnoses may be a matter of chance only, as in measles and chickenpox. The consistency of the increased duration wherever there are two or more diagnoses suggests that it is essential in morbidity tabulations involving the duration of illness to take account of complications, whether they represent sequelae, later stages of the disease, or chance occurrences. The small percentages of cases in this general morbidity study that are complicated, as compared with the large percentages of complicated hospital cases and the still larger percentages of deaths in which two

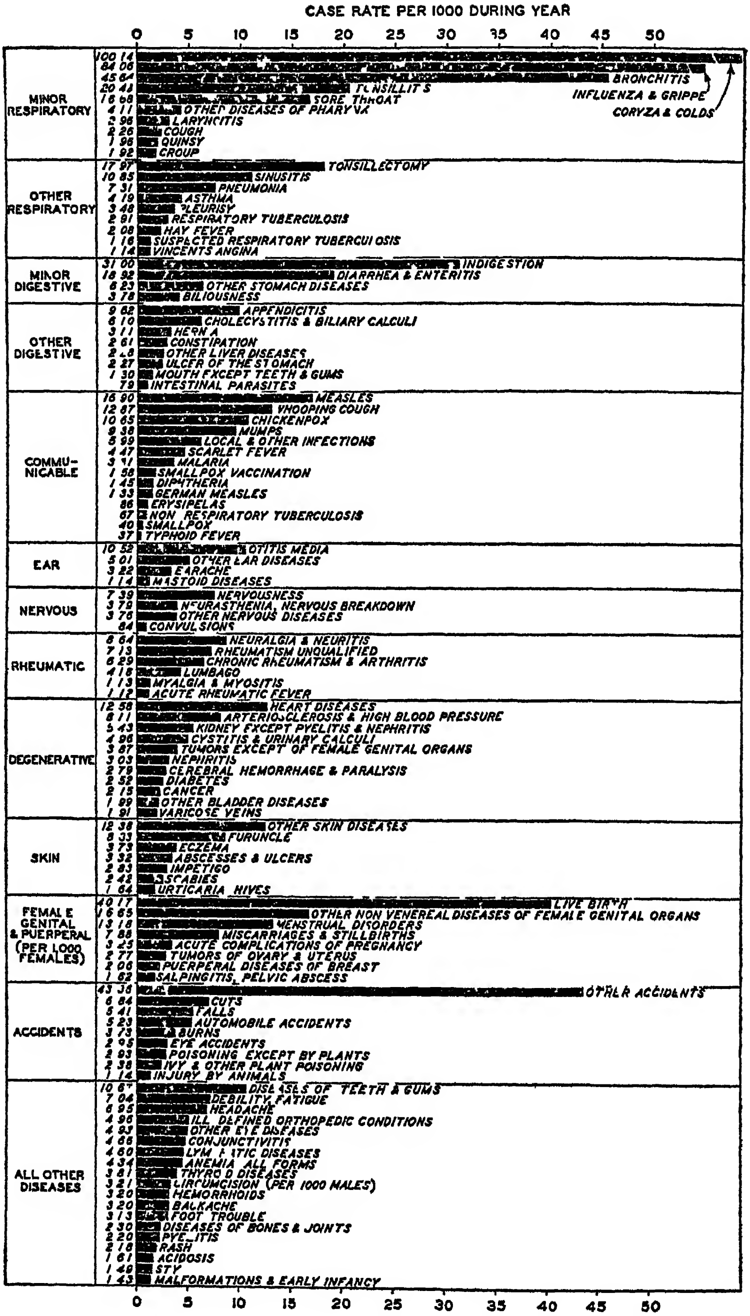

FIGURE 1.—Incidence of illness from specific causes arranged according to 13 broad disease groups—8 758 canvassed white families in 18 States during 12 consecutive months, 1928–31 (Rates adjusted to the age distribution of the white population of the death registration States, 1930.)

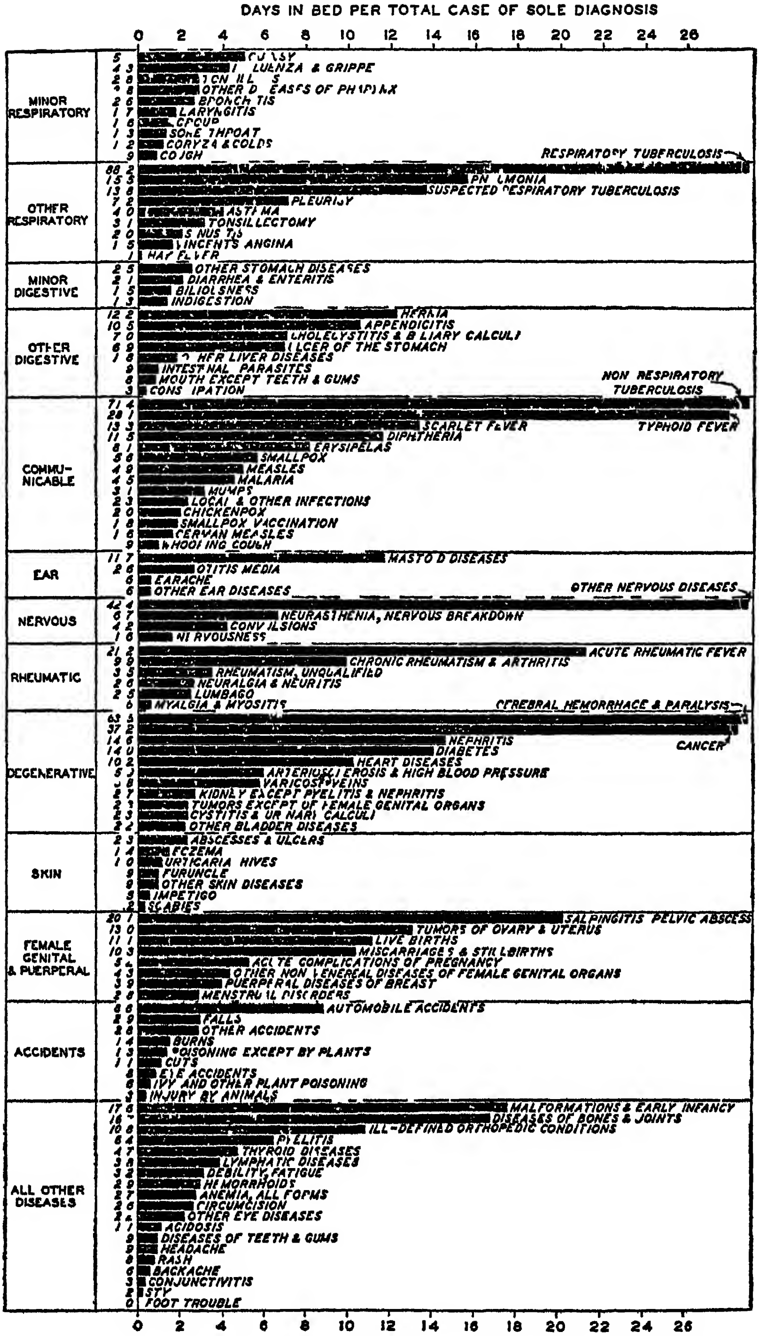

FIGURE 2.—Mean duration in bed per total illness of sole diagnosis for specific causes arranged according to 13 broad disease groups—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31.

or more causes are involved, suggest that the development of complications is an important factor in bringing the patient to the hospital and in causing fatal termination.

According to the different types of duration, tuberculosis, the nervous affections, and the degenerative diseases of old age are invariably the longest cases. The extreme length of these cases is particularly notable in the total duration of symptoms, but as noted above, tuberculosis, cancer, cerebral hemorrhage, and the nervous diseases also involve exceptionally long periods in bed. Acute diseases such as typhoid fever, acute rheumatic fever, pneumonia, scarlet fever, diphtheria, and mastoid diseases are among the diagnoses with the next longest durations in bed. Although the average time in bed is short for the various minor respiratory diseases, they occur so frequently that the aggregate days in bed per 1,000 persons under observation is greater than for any other disease group; this phase of the duration of illness was treated in the preceding paper (*14*).

III. DISTRIBUTIONS OF ILLNESSES ACCORDING TO VARIOUS TYPES OF DURATION

The approximate nature and the biases of durations as obtained in family canvasses have been discussed. In spite of these biases the average durations appear to be reasonably accurate. The tables presented in this section on the distribution of cases according to various types of duration will give some idea of the variability in the duration of cases of given diagnoses and will help the reader to evaluate the stability and usefulness of the averages.

Table 3 shows the distribution of cases of the 13 broad diagnosis groups according to the number of days in bed; data for all causes and for each diagnosis group are shown separately for illnesses of sole diagnosis, complicated cases (2 or more diagnoses), and for sole and primary diagnoses combined. Table 4 shows similar data for specific diseases but omits the small numbers of complicated cases, showing only those with a single diagnosis. It includes all diagnoses with 25 or more cases with a known number of days in bed; thus some diagnoses for which the average durations appear in table 2 are not included in this table because the numbers are too small to give a reliable distribution. Both tables show total cases, the percentage in bed for 1 or more days, and for those that were in bed the distribution according to days in bed. In computing this distribution, cases in bed, for an unknown number of days are omitted. The class intervals are irregular in length and in centering points; they were arranged in this way because of the approximate nature of the reports and the tendency of informants to give durations in round numbers such as 3, 5, and 7 days, 1, 2, and 3 weeks, and for the longer cases in months

TABLE 3.—*Distribution of illnesses from broad groups of causes according to duration of confinement to bed within the year of observation [1]—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

Disease group and whether sole cause or primary of 2 or more diagnoses [2]	Total number of cases	Percent of cases in bed for 1 or more days	Number of bed cases with known number of days in bed	Percent of bed cases with the specified number of days in bed during the year of observation: Bed cases with known days	1–2	3–5	6–8	9–11	12–17	18–24	25–45	46–365
All causes:												
Sole or primary	32,752	51.1	16,425	100	32.8	30.1	14.1	8.4	7.1	3.2	2.5	1.9
Sole	31,344	50.4	15,530	100	33.8	30.6	14.1	8.4	6.7	2.9	2.0	1.4
Complicated	2,942	65.9	1,801	100	15.4	19.8	12.9	8.6	13.8	8.7	10.2	10.8
Minor respiratory diseases:												
Sole or primary	11,330	59.0	6,618	100	38.1	37.2	14.7	5.0	3.4	1.1	.5	.1
Sole	10,835	59.0	6,331	100	38.8	37.4	14.6	4.7	3.1	.9	.4	-----
Complicated	618	62.3	374	100	21.1	29.7	17.6	10.7	10.7	5.1	4.5	.5
Other respiratory diseases:												
Sole or primary	2,091	72.1	1,481	100	36.1	29.2	9.8	5.5	7.7	4.2	3.3	4.3
Sole	1,981	71.3	1,385	100	37.7	29.3	9.8	5.4	7.5	3.9	2.7	3.7
Complicated	274	86.5	233	100	9.9	19.7	10.7	8.6	13.3	11.6	12.9	13.3
Minor digestive diseases:												
Sole or primary	2,323	49.0	1,103	100	56.4	28.4	9.2	2.8	1.6	1.0	.3	.4
Sole	2,253	49.2	1,074	100	56.9	28.7	8.9	2.7	1.3	.9	.3	.3
Complicated	184	48.4	87	100	30.1	25.3	10.3	4.6	11.5	2.3	1.1	5.7
Other digestive diseases:												
Sole or primary	1,031	60.2	619	100	21.5	16.0	8.1	9.2	19.5	12.3	9.5	3.2
Sole	944	59.3	558	100	23.3	17.6	8.6	9.9	18.5	12.2	8.8	1.3
Complicated	160	71.3	113	100	8.0	10.6	6.2	5.3	25.7	11.5	15.0	17.7
Communicable diseases:												
Sole or primary	3,671	61.0	2,203	100	19.8	36.0	22.3	8.3	7.1	3.6	2.1	.8
Sole	3,537	60.4	2,104	100	20.2	36.7	22.6	8.2	6.4	3.3	1.8	.8
Complicated	190	79.5	144	100	11.1	18.7	18.1	8.3	18.7	9.7	7.6	7.6
Ear and mastoid diseases:												
Sole or primary	723	38.9	274	100	33.2	24.5	19.7	9.9	5.8	5.1	1.8	-----
Sole	695	38.0	257	100	35.0	23.3	19.1	10.1	5.8	4.7	1.9	-----
Complicated	212	65.6	136	100	16.2	29.4	15.4	9.6	14.0	10.3	4.4	.7
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis:												
Sole or primary	499	40.3	193	100	27.5	18.7	10.4	8.8	10.4	3.6	9.3	11.4
Sole	478	38.7	177	100	29.9	18.1	11.3	8.5	9.6	4.0	8.5	10.2
Complicated	78	66.7	51	100	17.6	15.7	5.9	5.9	15.7	2.0	13.7	23.5
Rheumatism and related diseases:												
Sole or primary	797	40.9	320	100	28.5	26.7	14.7	4.6	10.1	6.1	5.5	3.7
Sole	769	40.2	309	100	28.0	27.8	14.9	4.5	10.0	5.8	5.2	2.9
Complicated	106	55.7	56	100	19.6	8.9	16.1	12.5	7.1	12.5	8.9	14.3
Degenerative diseases:												
Sole or primary	1,218	44.4	533	100	21.4	19.1	13.9	5.6	9.2	6.2	9.9	14.6
Sole	1,020	40.2	407	100	23.6	21.6	15.2	4.7	8.8	6.1	9.3	10.6
Complicated	410	69.3	276	100	14.9	10.5	10.1	9.4	10.9	8.7	12.0	23.6
Skin diseases:												
Sole or primary	1,311	13.1	162	100	35.2	30.9	11.1	4.9	6.8	4.9	4.3	1.9
Sole	1,320	13.0	159	100	35.8	30.8	11.3	5.0	6.3	4.4	4.4	1.9
Complicated	66	43.9	29	100	3.4	31.5	17.2	3.4	6.9	17.2	6.9	10.3
Female genital and puerperal diagnoses:												
Sole or primary	1,540	79.0	1,199	100	7.2	8.1	9.9	42.3	21.8	5.6	3.7	1.5
Sole	1,445	79.0	1,124	100	7.3	8.5	10.4	44.1	21.4	5.0	2.2	1.0
Complicated	197	77.7	151	100	4.0	4.6	4.0	11.9	25.8	14.6	25.2	9.9
Accidental injuries:												
Sole or primary	2,880	30.1	855	100	30.5	23.2	13.9	6.0	7.8	5.4	4.1	3.2
Sole	2,837	29.4	822	100	30.9	23.7	13.5	6.1	7.9	5.5	3.8	2.7
Complicated	52	73.1	38	100	23.7	7.9	21.1	7.9	5.3	2.6	13.2	18.4
All other diseases:												
Sole or primary	3,302	27.9	859	100	39.9	23.5	11.5	4.9	8.1	3.4	3.6	5.0
Sole	3,221	27.4	823	100	40.7	23.9	11.3	5.0	8.1	3.2	3.3	4.5
Complicated	305	52.7	203	100	15.3	26.6	14.8	4.4	9.9	7.4	9.9	11.8

[1] Cases with onset prior to the study and those still sick on the day of the last visit are included along with completed cases, but only for the days in bed that came within the study year. Average durations tend to be greater for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit. Prior onset of illness does not necessarily mean prior onset of confinement to bed.

[2] A case is considered as complicated if another diagnosis is reported as occurring simultaneously with or as overlapping the period of sickness from the diagnosis listed regardless of which diagnosis was classified as the primary cause of the illness. The complication may have a definite relationship to the other diagnosis (as in measles and pneumonia), or be apparently unrelated (as in measles and chickenpox). For inclusions in the diagnosis groups in terms of International List numbers, see table 1; table 2 and figs. 1 and 2 show the frequency and duration of specific causes included in the broad groups.

TABLE 4.—*Distribution of illnesses from specific causes*[1] *according to duration of confinement to bed within the year of observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole diagnosis only]

Diagnosis and International List numbers, 1920 revision	Total number of cases	Percent of cases in bed for 1 or more days	Number of bed cases with known number of days in bed	Percent of bed cases with the specified number of days in bed during the year of observation: Bed cases with known days	1–2	3–5	6–8	9–11	12–17	18–24	25–45	46–365
Minor respiratory diseases:												
Influenza and grippe (11)	3,152	84.6	2,661	100	26.1	41.3	18.9	7.1	4.7	1.3	0.6	0.1
Bronchitis and chest colds (99)	1,801	59.2	1,044	100	42.3	33.6	14.2	5.1	3.0	1.2	.5	.1
Coryza and colds, unqualified (pt. 97, pt. 107)	3,906	39.2	1,502	100	57.5	31.5	8.2	1.5	1.1	.2	----	----
Tonsillitis (pt. 109)	841	76.1	637	100	39.2	44.1	12.2	1.9	2.0	.5	----	----
Quinsy (pt. 109)	66	75.8	50	100	16.0	32.0	28.0	8.0	12.0	4.0	----	----
Sore throat (pt. 109)	621	37.2	230	100	51.7	32.2	11.3	2.2	1.3	----	1.3	----
Other pharynx and tonsil affections, except tonsillectomy (pt. 109)	138	55.1	76	100	25.0	38.2	22.4	10.5	1.3	2.6	----	----
Laryngitis (pt. 98)	104	47.1	49	100	42.9	36.7	16.3	4.1	----	----	----	----
Croup (pt. 98)	110	55.5	60	100	56.7	35.0	6.7	----	1.7	----	----	----
Other respiratory diseases:												
Tonsillectomy and adenoidectomy (pt. 109)	791	97.3	703	100	54.3	36.8	5.0	2.0	.9	.8	.3	----
Pneumonia, all forms (100, 101)	239	100.0	229	100	1.3	8.7	15.3	15.3	33.2	14.0	9.2	3.1
Sinusitis (pt. 97)	340	34.1	114	100	28.1	31.6	21.9	6.1	8.8	1.8	1.8	----
Asthma (105)	131	43.5	55	100	30.9	34.5	12.7	5.5	5.5	1.8	5.5	3.6
Pleurisy (102)	85	78.8	66	100	28.8	25.8	21.2	9.1	1.5	4.5	6.1	3.0
Respiratory tuberculosis (pt. 31)	92	65.2	59	100	8.5	1.7	----	3.4	6.8	8.5	8.5	62.7
Minor digestive diseases:												
Indigestion, upset stomach and nausea (pt. 112)	1,135	48.1	538	100	64.5	26.2	6.1	1.7	1.3	----	.2	----
Biliousness (pt. 112)	138	65.9	91	100	68.1	24.2	7.7	----	----	----	----	----
Other and ill-defined stomach diseases (pt. 112)	208	30.8	62	100	30.6	24.2	19.4	8.1	4.8	8.1	3.2	1.6
Diarrhea and enteritis (15, pt. 16, 113, 114)	773	52.8	383	100	47.8	33.9	11.5	3.9	1.0	1.3	----	.5
Other digestive diseases:												
Ulcers of stomach and duodenum (111)	70	45.7	32	100	9.4	21.9	6.3	12.5	21.9	18.7	3.1	6.3
Appendicitis (117)	291	85.9	250	100	14.0	14.4	8.0	14.0	28.0	13.2	7.6	.8
Hernia, intestinal obstruction (118)	89	59.6	51	100	7.8	5.9	5.9	5.9	23.5	27.5	19.6	3.9
Biliary calculi, cholecystitis (123, pt. 124)	162	67.9	110	100	30.9	20.0	11.8	4.5	8.2	11.8	11.8	.9
Other and ill-defined liver diseases (pt. 124)	65	40.0	26	100	57.7	23.1	15.4	----	----	----	3.8	----
Communicable diseases:												
Measles (7)	887	90.4	796	100	11.8	45.5	32.4	7.3	2.8	.3	----	----
German measles (pt. 25)	58	55.2	31	100	41.9	48.4	9.7	----			----	----
Whooping cough (9)	709	16.5	103	100	21.4	33.0	30.1	8.7	4.9	1.9	----	----
Chickenpox (pt. 25)	578	53.5	305	100	41.3	39.7	11.4	2.3	2.0	.3	----	----
Mumps (13)	446	61.7	271	100	24.8	41.2	21.5	7.7	2.9	1.5	.4	----
Scarlet fever (8)	215	93.0	199	100	4.5	8.0	13.1	17.1	26.1	20.1	10.1	1.0
Diphtheria (10)	68	98.5	67	100	4.5	17.9	22.4	17.9	23.9	11.9		1.5
Malaria (5)	118	80.5	95	100	27.4	42.1	12.6	8.4	5.3	3.2	1.1	----
Local and other infections not specified as accidental (41)	219	37.9	83	100	30.1	30.1	14.5	14.5	8.4	----	2.4	----
Smallpox vaccination (pt. 42)	76	67.1	51	100	51.0	41.2	5.9	2.0	----	----	----	----
Ear and mastoid diseases:												
Earache (pt. 86)	115	27.0	30	100	63.3	26.7	10.0					----
Otitis media (pt. 86)	390	45.4	173	100	31.8	26.6	21.4	11.0	6.4	2.3	.6	----
Diseases of the mastoid process (pt. 86)	40	90.0	35	100	8.6	11.4	20.0	17.1	11.4	22.9	8.6	----
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis:												
Nervousness (pt. 84)	220	24.5	53	100	34.0	28.3	9.4	5.7	13.2	7.5	1.9	----
Neurasthenia, nervous breakdown (pt. 84)	103	53.4	54	100	16.7	20.4	13.0	16.7	13.0	1.9	16.7	1.9
Convulsions, unqualified (79, 80)	40	72.5	29	100	62.1	17.2	10.3	3.4	----	----	3.4	3.4
Other nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis (70–73, 76–78, 81, pt. 84)	115	40.9	41	100	19.5	2.4	12.2	4.9	7.3	4.9	9.8	39.0

[1] The table includes only illnesses with a single diagnosis and with 25 or more bed cases with known number of days in bed. Cases with onset prior to the study and those still sick on the day of the last visit are included along with completed cases, but only for the days in bed that came within the study year. Average durations tend to be greater for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit. Prior onset of illness does not necessarily mean prior onset of confinement to bed.

TABLE 4.—*Distribution of illnesses from specific causes according to duration of confinement to bed within the year of observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*—Continued

Diagnosis and International List numbers, 1920 revision	Total number of cases	Percent of cases in bed for 1 or more days	Number of bed cases with known number of days in bed	Percent of bed cases with the specified number of days in bed during the year of observation								
				Bed cases with known days	1–2	3–5	6–8	9–11	12–17	18–24	25–45	46–365
Rheumatism and related diseases:												
Acute rheumatic fever (51)	82	84.4	27	100	18.5	3.7	22.2	3.7	14.8	3.7	25.9	7.4
Chronic rheumatism and arthritis (pt. 52)	141	35.5	50	100	12.0	26.0	14.0	2.0	24.0	10.0	2.0	10.0
Rheumatism, unqualified (pt. 52)	204	44.1	89	100	24.7	33.7	10.9	6.7	7.9	5.6	3.4	1.1
Neuralgia and neuritis (82)	235	32.8	77	100	44.2	19.5	11.7	5.2	7.8	7.8	2.6	1.3
Lumbago (pt. 158)	122	48.4	59	100	33.9	42.4	11.9	3.4	3.4	1.7	3.4	----
Degenerative diseases:												
Cancer, all sites (43–49)	42	66.7	28	100	3.6	----	14.3	----	7.1	10.7	25.0	39.3
Benign tumors, except of female organs (50)	114	24.6	28	100	35.7	14.3	28.6	----	7.1	7.1	3.6	3.6
Diseases of heart (87–90)	205	50.2	102	100	25.5	22.5	11.8	3.9	8.8	5.9	12.7	8.8
Arteriosclerosis and high blood pressure (pt. 91, pt. 96)	111	31.5	34	100	23.5	20.6	17.6	5.9	20.6	2.9	5.9	2.9
Nephritis, acute and chronic (128, 129)	47	55.3	26	100	23.1	23.1	11.5	11.5	7.7	7.7	7.7	7.7
Other and unspecified kidney diseases except pyelitis (pt. 131)	140	35.7	49	100	24.5	32.7	14.3	8.2	8.2	8.2	4.1	----
Cystitis and calculi of urinary passages (132, pt. 133)	134	44.8	60	100	33.3	33.3	21.7	5.0	1.7	5.0	----	----
Skin diseases:												
Furuncle (152)	307	16.9	51	100	47.1	31.4	3.9	5.9	7.8	2.0	2.0	----
Abscesses and ulcers (153, pt. 154)	116	35.3	38	100	23.7	39.5	18.4	5.3	5.3	2.6	5.3	----
Other and ill-defined skin diseases except impetigo, urticaria, scabies, and eczema (151, pt. 154, pt. 205)	446	9.6	41	100	31.7	24.4	12.2	4.9	7.3	9.8	9.8	----
Female genital and puerperal diagnoses:												
Cysts and tumors of ovary and uterus (137, 139)	33	75.8	25	100	8.0	20.0	12.0	8.0	20.0	4.0	20.0	8.0
Menstrual disorders (140, pt. 141)	212	48.6	103	100	41.7	26.2	13.6	6.8	5.8	3.9	1.0	1.0
Other and ill-defined nonvenereal diseases of female organs, including chronic results of childbirth (pt. 141, 142, pt. 145, pt. 149)	242	37.6	90	100	22.2	14.4	15.6	7.8	15.6	15.6	6.7	2.2
Abortions, miscarriages, and stillbirths (pt. 143)	136	97.8	133	100	4.5	19.5	21.1	19.5	21.8	9.0	3.8	.8
Live births (pt. 145, pt. 149)	735	100.0	719	100	.3	2.1	6.4	62.9	25.0	2.5	.4	.4
Accidental injuries:												
Other accidental poisonings (175, 176, pt. 177)	117	48.7	55	100	65.5	27.3	3.6	----	3.6	----	----	----
Automobile accidents (pt. 188)	189	71.4	134	100	29.1	20.9	15.7	5.2	11.2	4.5	7.5	6.0
Accidental burns (179)	152	21.7	31	100	22.6	38.7	10.4	3.2	9.7	----	6.5	----
Accidental injuries by cutting or piercing instruments (184)	288	19.8	57	100	38.6	26.3	17.5	3.5	7.0	5.3	1.8	----
Accidental falls (185)	191	32.5	62	100	33.9	22.6	12.9	9.7	4.8	4.8	9.7	1.6
All other accidents except ivy and other acute poisonings, eye injuries and injury by animals (165–174, 178, 180–183, 186, 187, pt. 188, 190–200, 201, pt. 202)	1,635	27.3	443	100	35.9	23.0	13.3	6.8	7.9	7.4	2.7	2.9
All other diseases:												
Diseases of thyroid gland (60)	113	26.5	28	100	7.1	10.7	21.4	7.1	28.6	10.7	7.1	7.1
Hemorrhoids (pt. 93)	100	30.0	30	100	20.0	20.0	16.7	6.7	23.3	3.3	10.0	----
Diseases of lymphatic system (94)	171	50.9	87	100	33.3	32.2	10.3	10.3	8.0	2.3	2.3	1.1
Diseases of the teeth and gums (pt. 108)	395	16.2	59	100	52.5	27.1	15.3	3.4	----	----	----	1.7
Pyelitis (pt. 131)	81	55.6	45	100	6.7	26.7	24.4	15.6	13.3	6.7	4.4	2.2
Circumcision (pt. 136)	80	72.5	29	100	55.2	24.1	10.3	6.9	3.4	----	----	----
Ill-defined orthopedic conditions and diseases of the organs of locomotion, except lumbago, myalgia, and myositis (157, pt. 158, pt. 205)	175	20.0	34	100	20.6	8.8	8.8	5.9	20.6	5.9	8.8	20.6
Congenital malformations and diseases of early infancy (159–163)	69	52.2	27	100	18.5	3.7	----	7.4	14.8	11.1	22.2	22.2
Headache (pt. 205)	234	46.2	108	100	84.3	12.0	1.9	----	1.9	----	----	----
Debility, fatigue, exhaustion, malnutrition, loss of weight (pt. 205)	233	20.6	46	100	41.3	30.4	13.0	----	6.5	2.2	----	6.5

only. Thus the intervals chosen put these points of concentration near the middle of the interval and give greater accuracy in classifying the cases.

In these and similar tables complete and incomplete cases are combined—thus some of the short cases may be explained by cases that were still incomplete on the last report from the family or that began prior to the study year with only part of the duration included within the period of observation. However, the incomplete cases average longer durations than the complete cases because the longer the case the greater the probability that the person will be still in bed at the last visit. Since all durations refer only to that part of the case that came within the study year, 365 days is the maximum

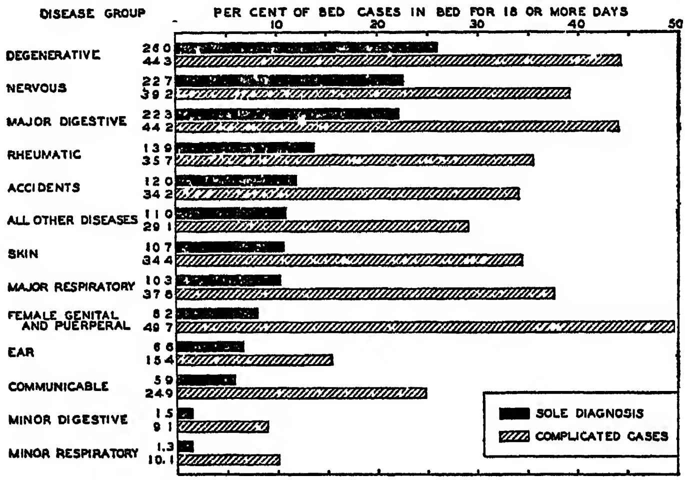

FIGURE 3.—Proportion of bed cases that were in bed for 18 or more days during the study year, for illnesses with sole diagnosis and for complicated cases—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31.

recorded duration of any case. No attempt is made to give a complete distribution—at the upper end the intervals are extremely large and give only an indication of how many cases fall into these rather long duration classes.

Table 3 indicates that for nearly all of the 13 broad diagnosis groups, a higher percentage of complicated cases were bed cases than was true of illnesses with only 1 diagnosis. Figure 3 shows the percentage of bed cases that were confined to bed for 18 days or longer. As already noted, the effect of a complication is to prolong the duration of the illness; in every instance a definitely higher percentage of complicated bed cases were in bed for 18 or more days than cases with only 1 diagnosis.

Tables 5 and 6 show distributions of cases according to the number of days of inability to work or pursue other usual activities (disa-

TABLE 5.—*Distribution of illnesses from broad groups of causes according to duration of disability [1] within the year of observation [2]—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

Disease group and whether sole or primary of 2 or more diagnoses [3]	Total number of cases	Percent of cases disabling for 1 or more days	Number of disabling cases with known number of days of disability	Percent of disabling cases with the specified number of days of disability during the year of observation: Disabling cases with known days	1-2	3-5	6-8	9-11	12-17	18-24	25-45	46-365
All causes:												
Sole or primary	32,752	60.7	14,310	100	20.1	22.3	15.9	10.2	13.7	6.7	6.7	4.4
Sole	31,344	60.1	13,508	100	20.6	22.8	16.2	10.3	13.8	6.4	6.3	3.6
Complicated	2,942	73.9	1,489	100	10.3	12.8	10.3	8.0	12.8	10.0	14.2	20.6
Minor respiratory diseases:												
Sole or primary	11,336	66.9	5,414	100	24.1	31.7	20.7	8.9	9.6	2.6	1.9	.4
Sole	10,835	66.8	5,183	100	24.5	32.0	20.9	8.9	9.4	2.5	1.6	.3
Complicated	618	72.3	284	100	13.4	21.8	16.5	10.9	14.8	8.8	9.9	3.9
Other respiratory diseases:												
Sole or primary	2,091	76.9	940	100	12.3	19.8	19.5	10.7	12.3	7.5	7.6	10.2
Sole	1,981	76.2	879	100	12.8	20.4	20.1	11.0	11.9	7.5	6.7	9.4
Complicated	274	89.8	102	100	5.6	9.9	9.9	7.4	13.6	9.3	19.8	24.7
Minor digestive diseases:												
Sole or primary	2,323	56.1	769	100	47.9	28.0	11.2	3.6	5.3	1.6	1.3	1.2
Sole	2,253	56.3	749	100	48.2	28.1	11.1	3.7	4.9	1.5	1.3	.8
Complicated	184	58.7	67	100	34.3	22.4	11.9	1.5	11.9	3.0	3.0	11.9
Other digestive diseases:												
Sole or primary	1,031	65.9	569	100	16.0	14.4	9.7	5.3	11.1	14.1	18.5	11.1
Sole	944	64.8	513	100	17.3	15.4	10.5	5.3	11.3	13.5	18.3	8.1
Complicated	160	75.0	94	100	3.2	5.3	3.2	4.3	10.6	18.1	22.3	33.0
Communicable diseases:												
Sole or primary	3,671	77.0	1,889	100	5.3	11.6	11.3	17.9	21.0	12.6	14.2	3.0
Sole	3,537	76.6	1,821	100	5.4	11.9	11.4	18.2	24.0	12.5	13.9	2.6
Complicated	190	90.0	103	100	1.9	5.8	6.8	8.7	21.4	15.5	21.4	18.4
Ear and mastoid diseases:												
Sole or primary	723	50.6	222	100	22.1	21.6	17.1	9.9	15.3	3.6	7.2	3.2
Sole	605	49.6	209	100	23.4	22.5	17.2	9.6	14.8	2.9	7.2	2.4
Complicated	212	72.6	87	100	5.7	18.4	17.2	11.5	17.2	12.6	9.2	8.0
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis:												
Sole or primary	499	48.3	173	100	13.3	15.0	13.3	5.2	9.8	5.2	16.2	22.0
Sole	478	47.1	163	100	14.1	15.3	14.1	4.3	10.4	5.5	16.0	20.2
Complicated	78	70.5	34	100	11.8	8.8	-----	8.8	8.8	5.9	11.8	49.1
Rheumatism and related diseases:												
Sole or primary	797	50.6	340	100	16.3	22.6	18.3	5.7	11.2	8.6	7.7	9.5
Sole	769	49.9	333	100	16.5	23.4	18.6	5.7	11.7	7.8	8.1	8.1
Complicated	106	63.2	51	100	7.8	9.8	17.6	9.8	3.9	9.8	13.7	27.5
Degenerative diseases:												
Sole or primary	1,218	52.0	487	100	16.4	15.6	12.7	6.0	9.4	8.2	9.7	22.0
Sole	1,020	47.5	383	100	17.5	17.0	15.4	6.0	9.9	7.6	9.4	17.2
Complicated	410	78.0	235	100	15.7	8.9	3.8	7.2	10.2	11.1	10.2	32.8
Skin diseases:												
Sole or primary	1,341	28.4	316	100	15.5	24.1	16.1	8.9	15.5	10.1	6.6	3.2
Sole	1,329	28.1	309	100	15.9	24.3	16.2	8.1	15.5	10.0	6.8	3.2
Complicated	66	66.7	32	100	3.1	15.6	18.7	21.9	3.1	12.5	6.3	18.7
Female genital and puerperal diagnoses:												
Sole or primary	1,540	80.6	1,103	100	5.2	6.1	7.9	20.2	34.1	13.4	9.5	3.6
Sole	1,445	80.6	1,083	100	5.2	6.4	8.1	21.2	35.4	13.2	8.0	2.4
Complicated	197	78.2	140	100	2.9	3.6	4.3	5.7	14.3	15.0	32.9	21.4
Accidental injuries:												
Sole or primary	2,880	48.2	1,170	100	23.7	19.1	14.3	8.1	10.1	8.3	9.3	7.2
Sole	2,837	47.6	1,143	100	24.1	19.2	14.8	8.1	10.2	8.1	9.3	6.7
Complicated	52	88.5	34	100	5.9	11.8	17.6	8.8	2.9	14.7	8.8	29.4
All other diseases:												
Sole or primary	3,302	37.3	900	100	33.1	20.3	13.2	6.0	10.1	5.2	5.1	6.9
Sole	3,221	36.9	865	100	33.8	20.6	13.1	5.9	10.3	5.0	5.1	6.4
Complicated	395	61.3	166	100	13.3	16.9	13.3	5.4	12.0	8.4	7.2	23.5

[1] Disability refers to inability to work, attend school, care for home, or pursue other usual activities, regardless of employment status and age.

[2] Cases with onset prior to the study and those still sick on the last visit are included along with completed cases but only for the days of disability that came within the study year. Average durations tend to be greater for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit. Prior onset of illness does not necessarily mean prior onset of disability.

[3] A case is considered as complicated if another diagnosis is reported as occurring simultaneously with or as overlapping the period of sickness from the diagnosis listed regardless of which diagnosis was classified as the primary cause of the illness. The complication may have a definite relationship to the other diagnosis (as in measles and pneumonia), or be apparently unrelated (as in measles and chickenpox). For inclusions in the diagnosis groups in terms of International List numbers, see table 1; table 2 and figs. 1 and 2 show the frequency and duration of specific causes included in the broad groups.

TABLE 6.—*Distribution of illnesses from specific causes* [1] *according to duration of disability* [2] *within the year of observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole diagnosis only]

Diagnosis and International List numbers, 1920 revision	Total number of cases	Percent of cases disabling for 1 or more days	Number of disabling cases with known number of days of disability	Percent of disabling cases with the specified number of days of disability during the year of observation								
				Disabling cases with known days	1–2	3–5	6–8	9–11	12–17	18–24	25–45	46–365
Minor respiratory diseases:												
Influenza and grippe (11)	3,152	88.8	2,063	100	14.8	30.2	23.1	12.3	13.3	3.4	2.4	0.5
Bronchitis and chest colds (99)	1,801	66.1	771	100	24.0	27.5	23.5	10.1	10.5	2.5	1.6	.4
Coryza and colds, unqualified (pt. 97, pt. 107)	3,906	49.7	1,390	100	39.6	38.5	10.2	4.8	4.7	.6	.5	----
Cough (pt. 107)	100	37.0	28	100	17.9	39.3	10.7	10.7	7.1	3.6	7.1	3.6
Tonsillitis (pt. 109)	841	83.1	506	100	21.1	40.1	22.5	7.1	6.3	2.4	.4	----
Quinsy (pt. 109)	66	84.8	52	100	8.8	19.2	32.7	5.8	15.4	15.4	7.7	----
Sore throat (pt. 100)	621	49.1	239	100	34.3	38.1	16.3	4.6	4.2	1.3	1.3	----
Other pharynx and tonsil affections, except tonsillectomy (pt. 109)	138	60.9	67	100	20.9	25.4	22.4	9.0	13.4	6.0	1.5	1.5
Laryngitis (pt. 98)	104	53.8	41	100	19.5	30.0	22.0	7.3	9.8	2.4	----	----
Croup (pt. 98)	110	66.4	32	100	31.3	43.7	15.6	3.1	3.1	3.1	----	----
Other respiratory diseases:												
Tonsillectomy and adenoidectomy (pt. 109)	791	97.9	371	100	8.6	27.0	31.8	15.4	12.1	2.4	2.4	.3
Pneumonia, all forms (100, 101)	239	100.0	118	100	1.7	2.5	6.8	6.8	24.6	25.4	22.9	9.3
Sinusitis (pt. 97)	340	45.9	136	100	21.3	24.3	14.7	8.1	14.7	8.8	4.4	3.7
Asthma (105)	131	55.0	56	100	30.4	19.6	16.1	5.4	7.1	10.7	1.8	8.9
Pleurisy (102)	85	80.4	66	100	27.3	19.7	19.7	7.6	9.1	9.1	1.5	6.1
Respiratory tuberculosis (pt. 31)	92	73.9	55	100	----	1.8	----	1.8	1.8	7.3	7.3	80.0
Minor digestive diseases:												
Indigestion, upset stomach and nausea (pt. 112)	1,135	56.6	407	100	56.5	24.1	9.1	4.2	4.2	.7	.5	.7
Biliousness (pt. 112)	138	73.2	77	100	44.2	44.2	7.8	1.3	2.6	----	----	----
Other and ill-defined stomach diseases (pt. 112)	208	42.3	53	100	28.3	30.2	15.1	3.8	9.4	5.7	5.7	1.9
Diarrhea and enteritis (15, pt. 16, 113, 114)	773	56.9	214	100	38.8	30.4	15.4	3.7	6.1	2.3	2.3	.9
Other digestive diseases:												
Ulcers of stomach and duodenum (111)	70	58.6	38	100	7.9	21.1	15.8	2.6	13.2	7.9	13.2	18.4
Appendicitis (117)	291	88.3	227	100	10.1	11.0	11.5	5.7	12.3	17.2	27.3	4.8
Hernia, intestinal obstruction (118)	89	64.0	42	100	11.9	2.4	----	4.8	4.8	21.4	26.2	28.6
Biliary calculi, cholecystitis (123, pt. 124)	162	71.0	97	100	25.8	15.5	11.3	4.1	13.4	9.3	12.4	8.2
Other and ill-defined liver diseases (pt. 124)	65	55.4	29	100	37.9	24.1	17.2	6.9	10.3	----	3.4	----
Communicable diseases:												
Measles (7)	887	93.2	420	100	1.9	20.5	17.9	32.4	22.8	3.7	.2	.5
German measles (pt. 25)	58	81.0	42	100	14.3	64.3	9.5	4.8	7.1	----	----	----
Whooping cough (9)	708	45.9	204	100	3.4	2.9	5.4	1.5	8.8	11.8	58.3	7.8
Chickenpox (pt. 25)	578	76.8	316	100	1.9	9.2	15.2	20.7	35.4	8.5	----	----
Mumps (13)	446	85.2	308	100	5.5	18.8	17.2	22.1	25.6	9.4	1.3	----
Scarlet fever (8)	215	97.2	152	100	2.0	2.6	3.3	7.9	8.6	32.9	12.1	.7
Diphtheria (10)	68	98.5	45	100	2.2	4.4	2.2	4.4	37.8	31.1	15.6	2.2
Malaria (5)	118	82.2	76	100	14.5	34.2	25.0	9.2	9.2	1.3	6.6	----
Local and other infections not specified as accidental (41)	219	57.5	109	100	13.8	13.8	23.9	13.8	15.6	11.9	6.4	.9
Smallpox vaccination (pt. 42)	76	94.7	57	100	40.4	40.4	15.8	1.8	1.8	----	----	----
Ear and mastoid diseases:												
Earache (pt. 86)	115	44.3	34	100	47.1	38.2	8.8	2.9	2.9	----	----	----
Otitis media (pt. 86)	300	57.7	135	100	20.0	20.0	18.5	10.4	20.0	3.7	7.4	----
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis:												
Nervousness (pt. 84)	220	30.5	61	100	21.3	21.3	13.1	3.3	11.5	6.6	18.0	4.9
Neurasthenia, nervous breakdown (pt. 84)	103	65.0	56	100	5.4	12.5	17.9	7.1	12.5	7.1	14.3	23.2
Other nervous diseases except cerebral hemorrhage, paralysis, neuralgia, neuritis, and convulsions (70–73, 76–78, 81, pt. 84)	115	52.2	39	100	10.3	10.3	7.7	2.6	5.1	2.6	15.4	46.2

[1] The table includes only illnesses with a single diagnosis and with 25 or more disabling cases with known number of days of disability. Cases with onset prior to the study and those still sick on the last visit are included along with completed cases but only for the days of disability that came within the study year. Average durations tend to be greater for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit. Prior onset of illness does not necessarily mean prior onset of disability.

[2] Disability refers to inability to work, attend school, care for home, or pursue other usual activities, regardless of employment status and age.

TABLE 6.—*Distribution of illnesses from specific causes according to duration of disability within the year of observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*—Continued

Diagnosis and International List numbers, 1920 revision	Total number of cases	Percent of cases disabling for 1 or more days	Number of disabling cases with known number of days of disability	Percent of disabling cases with the specified number of days of disability during the year of observation: Disabling cases with known days	1-2	3-5	6-8	9-11	12-17	18-24	25-45	46-365
Rheumatism and related diseases:												
Acute rheumatic fever (51)	32	87.5	27	100	----	11.1	22.2	.	14.8	11.1	25.9	14.8
Chronic rheumatism and arthritis (pt. 52)	141	44.0	51	100	5.9	13.7	17.6	3.9	15.7	3.9	13.7	25.5
Rheumatism, unqualified (pt. 52)	204	52.0	93	100	9.7	21.7	19.4	9.7	15.1	12.9	5.4	3.2
Neuralgia and neuritis (82)	235	43.4	84	100	31.0	27.4	13.1	2.4	7.1	7.1	7.1	1.8
Lumbago (pt. 158)	122	64.8	72	100	22.2	20.2	20.8	8.3	9.7	4.2	2.8	2.8
Degenerative diseases:												
Benign tumors, except of female organs (50)	114	34.2	30	100	33.3	6.7	23.3	10.0	6.7	10.0	3.3	6.7
Diseases of heart (87-90)	205	59.0	95	100	13.7	15.8	16.8	5.3	12.6	3.2	10.5	22.1
Arteriosclerosis and high blood pressure (pt. 91, pt. 96)	111	33.3	25	100	24.0	16.0	20.0	4.0	8.0	12.0	8.0	8.0
Other and unspecified kidney diseases except pyelitis (pt. 131)	140	45.7	50	100	16.0	20.0	14.0	10.0	14.0	12.0	12.0	2.0
Cystitis, and calculi of urinary passages (132, pt. 133)	134	53.7	63	100	23.8	30.2	19.0	6.3	9.5	6.3	1.6	3.2
Skin diseases:												
Furuncle (152)	307	31.9	85	100	21.2	32.9	10.6	7.1	15.3	7.1	1.2	4.7
Abscesses and ulcers (153, pt. 151)	116	51.7	46	100	6.5	21.7	28.3	15.2	15.2	4.3	8.7	--
Impetigo (pt. 154)	138	26.8	30	100	6.7	13.3	13.3	13.3	20.0	26.7	6.7	-
Scabies (pt. 154)	106	40.6	39	100	10.3	23.1	7.7	.	17.9	20.5	10.3	10.3
Other and ill-defined skin diseases except urticaria and eczema (151, pt. 154, pt. 205)	446	20.0	75	100	18.7	18.7	24.0	6.7	17.3	4.0	8.0	2.7
Female genital and puerperal diagnoses:												
Menstrual disorders (140, pt. 141)	212	53.8	105	100	27.6	31.4	15.2	3.8	11.4	5.7	3.8	1.0
Other and ill-defined nonvenereal diseases of female organs, including chronic results of childbirth (pt. 141, 142, pt. 145, pt. 149)	242	42.1	79	100	22.8	8.9	6.3	10.1	12.7	11.4	16.5	11.4
Abortions, miscarriages, and stillbirths (pt. 143)	136	99.3	121	100	3.3	7.4	24.0	10.7	22.3	16.5	12.4	3.3
Live births (pt. 145, pt. 149)	735	100.0	664	100	----	.9	3.5	28.9	46.4	13.9	6.0	.5
Accidental injuries:												
Poisoning by ivy, oak, and other plants (pt. 177)	96	35.4	28	100	32.1	42.9	10.7	7.1	3.6	3.6	----	----
Other accidental poisonings (175, 176, pt. 177)	117	54.7	53	100	45.3	35.8	13.2	3.8	.	1.0	..	-
Automobile accidents (pt. 188)	189	81.0	132	100	17.4	13.6	14.4	6.1	12.9	11.4	11.4	12.9
Accidental burns (179)	152	38.2	45	100	22.2	22.2	20.0	4.4	8.9	11.1	11.1	--
Accidental injuries by cutting or piercing instruments (184)	288	36.8	77	100	22.1	19.5	11.7	13.0	15.6	7.8	6.5	3.9
Accidental falls (185)	191	47.1	70	100	18.6	22.9	14.3	5.7	14.3	10.0	5.7	8.6
Eye accidents (pt. 85, pt. 202)	118	32.2	32	100	37.5	15.6	6.3	12.5	9.4	-	12.5	6.3
All other accidents except injury by animals (165-174, 178, 180-183, 186, 187, pt. 188, 190-200, 201, pt. 202)	1,635	48.5	605	100	23.7	17.0	14.2	8.6	9.9	8.3	10.5	7.1
All other diseases:												
Anemia, all forms (58)	114	28.1	28	100	10.7	21.4	7.1	7.1	14.3		10.7	28.6
Diseases of thyroid gland (60)	113	29.2	26	100	----	7.7	7.7	3.8	23.1	19.2	15.4	23.1
Conjunctivitis, pinkeye, sore eye (pt. 85)	199	46.2	81	100	24.7	34.6	14.8	11.1	12.3	1.2	1.2	---
Other eye diseases (pt. 85)	159	29.6	41	100	24.4	19.5	14.6	---	17.1	7.3	4.9	12.2
Hemorrhoids (pt. 93)	100	37.0	34	100	29.4	20.6	2.9		20.6	2.9	20.6	2.9
Diseases of lymphatic system (94)	171	59.6	57	100	15.8	17.5	26.3	10.5	14.0	8.8	5.3	1.8
Diseases of the teeth and gums (pt. 108)	305	25.6	67	100	41.8	26.9	17.9	3.0	4.5	6.0	----	----
Pyelitis (pt. 131)	81	63.0	41	100	4.9	14.6	19.5	12.2	24.4	7.3	12.2	4.9
Ill-defined orthopedic conditions and diseases of the organs of locomotion, except lumbago, myalgia, and myositis (157, pt. 158, pt. 205)	175	20.0	44	100	13.6	2.3	11.4	11.4	15.9	4.5	9.1	31.8
Headache (pt. 205)	234	56.4	122	100	79.5	13.9	3.3	..	2.5	.8	----	----
Backache (pt. 205)	102	30.4	30	100	43.3	36.7	16.7	3.3	---	----	----	----
Debility, fatigue, exhaustion, malnutrition, loss of weight (pt. 205)	233	27.0	56	100	25.0	30.4	10.7	7.1	12.5	3.6	5.4	5.4

TABLE 7.—*Distribution of illnesses from broad groups of causes according to total duration of symptoms within the year of observation*[1]*—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

Disease group and whether sole cause or primary of 2 or more diagnoses[2]	Number of cases with known duration of symptoms	Percent of cases with the specified total duration of symptoms, in days, during the year of observation									
		All cases of known duration	Less than 3	3–5	6–8	9–11	12–17	18–24	25–45	46–75	76–365
All causes:											
Sole or primary	30,782	100	8.9	19.4	20.4	9.9	15.0	6.7	8.9	2.8	8.2
Sole	29,420	100	9.2	19.8	20.8	10.0	15.0	6.6	8.6	2.5	7.4
Complicated	2,825	100	3.3	9.5	10.7	7.2	13.2	8.0	14.3	7.5	26.3
Minor respiratory diseases:											
Sole or primary	11,037	100	6.8	28.4	30.0	11.4	13.8	4.9	3.5	.6	.6
Sole	10,551	100	7.0	28.8	30.6	11.5	13.5	4.7	3.1	.4	.5
Complicated	596	100	3.0	16.6	17.1	11.2	20.8	8.9	13.6	4.2	4.5
Other respiratory diseases:											
Sole or primary	1,930	100	4.6	16.6	21.4	8.9	14.5	7.6	9.2	3.4	13.9
Sole	1,822	100	4.8	17.0	22.0	9.1	14.7	7.6	8.6	3.0	13.3
Complicated	269	100	2.6	5.9	9.3	6.7	9.7	9.3	20.4	10.0	26.0
Minor digestive diseases:											
Sole or primary	2,245	100	26.5	30.5	17.8	5.3	7.0	3.5	3.9	1.2	4.3
Sole	2,181	100	27.1	31.1	18.1	5.0	7.1	3.3	3.7	1.0	3.6
Complicated	173	100	7.5	16.8	16.8	8.1	10.4	6.9	10.4	5.2	17.9
Other digestive diseases:											
Sole or primary	975	100	8.5	10.6	11.6	5.8	12.5	9.7	15.3	5.9	20.0
Sole	892	100	9.2	11.0	12.4	6.1	13.0	9.5	15.5	5.4	17.9
Complicated	155	100	2.6	8.4	3.9	3.9	8.4	11.0	14.8	10.3	36.8
Communicable diseases:											
Sole or primary	3,581	100	1.6	9.6	14.5	12.8	25.6	9.3	19.7	4.6	2.4
Sole	3,447	100	1.6	9.8	14.7	12.9	25.9	9.3	19.4	4.4	2.0
Complicated	189	100	.5	3.2	6.9	9.5	19.6	9.0	28.6	10.6	12.2
Ear and mastoid diseases:											
Sole or primary	693	100	14.0	16.9	17.6	9.2	15.0	7.4	11.1	2.8	6.5
Sole	666	100	14.6	17.6	17.6	9.2	15.0	7.4	10.5	2.3	6.0
Complicated	204	100	2.5	11.3	15.2	11.3	21.6	11.8	15.7	6.4	4.4
Nervous diseases, except cerebral hemorrhage, paralysis, neuralgia, and neuritis:											
Sole or primary	451	100	8.2	10.2	8.4	4.0	8.0	6.4	10.9	8.2	35.7
Sole	432	100	8.3	10.2	8.8	3.9	7.9	6.5	11.1	8.1	35.2
Complicated	72	100	4.2	9.7	1.4	4.2	13.9	2.8	8.3	5.6	50.0
Rheumatism and related diseases:											
Sole or primary	747	100	4.1	11.2	13.5	8.2	13.9	7.6	12.6	4.4	24.4
Sole	721	100	4.3	11.7	13.7	8.5	14.1	7.8	12.6	4.4	22.9
Complicated	101	100	2.0	5.0	9.9	4.0	6.9	7.9	11.9	3.0	49.5
Degenerative diseases:											
Sole or primary	1,110	100	4.8	6.2	9.9	4.8	7.7	6.7	10.1	5.1	44.7
Sole	923	100	5.1	6.7	10.8	5.5	8.9	7.4	10.7	4.4	40.4
Complicated	394	100	4.3	3.8	6.1	2.3	5.3	4.3	9.1	8.6	56.1
Skin diseases:											
Sole or primary	1,229	100	6.4	9.8	16.8	9.8	14.8	10.3	14.6	6.2	11.3
Sole	1,218	100	6.4	9.9	16.8	9.9	14.9	10.3	14.6	6.0	11.2
Complicated	63	100	------	7.9	20.6	1.6	15.9	3.2	7.9	19.0	23.8
Female genital and puerperal diagnoses:											
Sole or primary	1,420	100	3.7	4.4	6.1	17.8	32.3	9.1	9.9	4.2	12.5
Sole	1,328	100	3.8	4.7	6.5	18.7	33.7	9.3	9.1	3.5	10.7
Complicated	190	100	1.1	1.1	1.1	3.7	11.6	6.3	18.9	13.2	43.2
Accidental injuries:											
Sole or primary	2,679	100	10.9	17.4	18.4	9.4	14.3	9.9	12.9	3.5	3.3
Sole	2,639	100	11.0	17.5	18.5	9.4	14.3	9.9	12.9	3.4	3.0
Complicated	49	100	4.1	6.1	10.2	10.2	12.2	12.2	12.2	8.2	24.5
All other diseases:											
Sole or primary	2,685	100	19.4	15.5	12.9	5.8	9.5	5.3	8.4	3.5	19.6
Sole	2,609	100	19.8	15.7	13.0	5.7	9.6	5.3	8.8	3.6	19.0
Complicated	370	100	5.2	12.4	10.8	7.6	9.7	8.1	10.5	5.7	30.0

[1] Cases with onset prior to the study and those still sick on the last visit are included along with completed cases, but only for the days of sickness that came within the study year. Average durations tend to be greater for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit.

[2] A case is considered as complicated if another diagnosis is reported as occurring simultaneously with or as overlapping the period of sickness from the diagnosis listed regardless of which diagnosis was classified as the primary cause of the illness. The complication may have a definite relationship to the other diagnosis (as in measles and pneumonia), or be apparently unrelated (as in measles and chickenpox). For inclusions in the diagnosis groups in terms of International List numbers, see table 1; table 2 and figs. 1 and 2 show the frequency and duration of specific causes included in the broad groups.

bility); the arrangement and inclusions in the tables are similar to those already discussed in connection with duration in bed. Table 6 for specific diseases includes all diagnoses with 25 or more cases with a known number of days of disability. Because there were rather large numbers of disabling cases in which the actual number of days of disability was unknown, diagnoses are missing from this table which might be expected from the total number of cases if all had been of known disabling duration.

Tables 7 and 8 show the distribution of cases according to the total duration of symptoms, including nondisabled as well as disabled days. The extremely approximate nature of this item has already been discussed.

IV. SUMMARY

Data on the frequency and duration of illness during a 12-month period between 1928 and 1931 were obtained for 8,758 white families in 130 localities in 18 States. Durations within the study year were recorded in three ways: (*a*) Days in bed, (*b*) days of inability to work or pursue other usual activities (disability), and (*c*) the total duration of symptoms. Each family was visited at intervals of 2 to 4 months to obtain the information.

The mean duration [13] for illness from all causes was 4.3 days in bed per total case, and 8.5 days in bed per bed case; 51 percent of the total recorded cases were in bed for 1 or more days. For 13 broad diagnosis groups, the duration in bed per total case of sole diagnosis ranged from 1.0 days for skin diseases and 1.7 days for minor digestive cases to 9.6 days for the degenerative diseases of old age and 12.2 for the nervous diseases. Of specific diseases, respiratory tuberculosis showed the longest duration in bed per total case. Fortunately, the diseases with the highest incidence, such as the minor respiratory and minor digestive affections, have the shortest average durations in bed (figs. 1 and 2). Their frequent occurrence, however, makes them responsible for a large aggregate number of days in bed per year.

Considering broad diagnosis groups, the nervous diseases, with 39 percent of the cases of sole diagnosis in bed for 1 or more days, show the longest duration in bed or hospital per bed case, 31.5 days; the minor digestive diseases, with 49 percent in bed for 1 or more days, show the shortest duration with 3.4 days in bed per bed case. In terms of disability also, the nervous diseases, with 47 percent causing disability for 1 or more days, show the longest duration of disability, 46.6 disabled days per disabling case; the minor digestive diseases, with 56 percent causing disability for 1 or more days, show the shortest duration with 5.5 days disabled per disabling case. In total duration

[13] In a preceding paper (*14*) some mean durations were quoted that represented ratios between case and day rates per 1,000 that had been adjusted to a standard population; the durations in the present paper are based on actual cases and days and thus differ somewhat from that study.

TABLE 8.—*Distribution of illnesses from specific causes*[1] *according to total duration of symptoms within the year of observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

[Sole diagnosis only]

Diagnosis and International List numbers, 1920 revision	Number of cases with known duration of symptoms	Percent of cases with the specified total duration of symptoms, in days, during the year of observation									
		All cases of known duration	Less than 3	3–5	6–8	9–11	12–17	18–24	25–45	46–75	76–365
Minor respiratory diseases:											
Influenza and grippe (11)	3,098	100	4.0	24.0	30.7	14.5	17.3	5.6	3.6	0.3	0.1
Bronchitis and chest colds (99)	1,772	100	3.3	20.7	31.0	14.3	18.1	6.6	4.4	.7	.9
Coryza and colds, unqualified (pt. 97, pt. 107)	3,747	100	9.9	34.5	31.7	8.5	9.5	3.2	1.9	.3	.4
Cough (pt. 107)	93	100	8.6	20.4	16.1	8.6	18.3	11.8	7.5	4.3	4.3
Tonsillitis (pt. 109)	830	100	8.0	36.7	31.9	9.8	9.6	3.1	.8	----	----
Quinsy (pt. 109)	65	100	------	6.2	29.2	20.0	21.5	15.4	7.7	----	----
Sore throat (pt. 109)	614	100	11.2	32.9	26.7	9.6	10.7	3.3	4.6	.3	.7
Other pharynx and tonsil affections, except tonsillectomy (pt. 109)	128	100	4.7	20.7	20.3	9.4	15.6	7.0	5.5	3.1	4.7
Laryngitis (pt. 98)	100	100	7.0	32.0	27.0	11.0	9.0	5.0	7.0	1.0	1.0
Croup (pt. 98)	108	100	24.1	35.2	29.6	4.6	2.8	.9	2.8	----	----
Other respiratory diseases:											
Tonsillectomy and adenoidectomy (pt. 109)	727	100	7.0	29.0	37.0	10.6	10.7	2.8	2.6	.3	----
Pneumonia, all forms (100, 101)	235	100	.9	2.1	8.9	6.4	26.4	23.4	21.3	6.0	1.7
Sinusitis (pt. 97)	813	100	3.2	10.5	14.4	11.2	18.8	6.7	15.0	6.1	14.1
Asthma (105)	122	100	8.2	10.7	12.3	4.1	12.3	5.7	4.9	2.5	39.3
Hay fever (pt. 107)	58	100	5.1	8.6	--	1.7	12.1	8.6	25.9	8.6	29.3
Pleurisy (102)	85	100	3.5	18.8	27.1	11.8	15.3	14.1	3.5	1.2	4.7
Respiratory tuberculosis (pt. 31)	84	100	------	1.2	----	----	----	----	1.2	2.4	95.2
Minor digestive diseases:											
Indigestion, upset stomach and nausea (pt. 112)	1,102	100	31.7	30.3	17.1	4.7	6.6	3.5	3.4	.9	1.7
Biliousness (pt. 112)	134	100	33.6	39.6	20.1	2.2	.7	----	2.2	.7	.7
Other and ill-defined stomach diseases (pt. 112)	191	100	15.1	14.7	16.8	6.8	9.9	4.2	9.9	3.7	18.8
Diarrhea and enteritis (15, pt. 16, 113, 114)	755	100	22.4	35.0	19.5	5.6	8.1	3.2	2.8	.5	3.0
Other digestive diseases:											
Ulcers of stomach and duodenum (111)	64	100	------	4.7	4.7	3.1	6.3	4.7	14.1	7.8	54.7
Appendicitis (117)	282	100	5.7	9.6	11.7	5.7	17.0	17.7	23.8	3.9	5.0
Hernia, intestinal obstruction (118)	82	100	2.4	1.2	4.9	3.7	9.8	12.2	18.3	11.0	36.6
Constipation (pt. 119)	73	100	24.6	17.8	6.8	1.4	5.5	5.5	1.4	1.4	35.6
Biliary calculi, cholecystitis (123, pt. 124)	157	100	13.4	8.3	14.0	5.7	12.7	3.8	16.6	5.7	19.7
Other and ill-defined liver diseases (pt. 124)	61	100	4.9	14.8	14.8	18.0	21.3	1.6	8.2	4.9	11.5
Diseases of the mouth except teeth and gums (pt. 108)	53	100	7.5	24.5	28.3	11.3	13.2	3.8	3.8	----	7.5
Communicable diseases:											
Measles (7)	875	100	.8	10.5	21.9	23.3	33.0	3.5	.8	.1	----
German measles (pt. 25)	58	100	------	56.9	29.3	6.9	6.9			--	--
Whooping cough (9)	680	100	.4	.3	.3	1.6	5.4	7.2	63.5	18.8	2.4
Chickenpox (pt. 25)	561	100	.7	4.1	10.7	10.6	51.7	11.9	1.2	--	----
Mumps (13)	434	100	1.2	11.8	23.7	13.6	32.9	14.7	2.1	-	---
Scarlet fever (8)	211	100	.9	.5	1.9	1.4	10.4	20.4	61.1	2.8	.5
Diphtheria (10)	68	100	---	4.4	10.3	4.4	32.4	30.9	16.2	1.5	----
Malaria (5)	117	100	6.0	26.5	34.2	9.4	10.3	4.3	7.7	.9	.9
Local and other infections not specified as accidental (41)	214	100	1.4	10.7	23.8	12.1	22.4	7.5	15.4	4.7	1.9
Smallpox vaccination (pt. 42)	70	100	22.9	31.4	25.7	2.9	7.1	4.3	4.3	---	1.4
Ear and mastoid diseases:											
Earache (pt. 86)	104	100	27.9	36.5	14.4	6.7	8.7	1.0	3.8	----	1.0
Otitis media (pt. 86)	380	100	3.9	16.1	21.6	11.6	20.0	8.4	12.9	2.1	3.4
Other ear diseases (pt. 86)	143	100	36.4	12.6	11.2	7.0	8.4	6.3	4.9	1.4	11.9

[1] The table includes only illnesses with a single diagnosis and with 50 or more cases of known duration of symptoms. Cases with onset prior to the study and those still sick on the last visit are included along with completed cases, but only for the days of sickness that came within the study year. Average durations tend to be greater for incomplete than for complete cases because the longer the case the greater the probability that it will be still sick at the last visit.

TABLE 8.—*Distribution of illnesses from specific causes according to total duration of symptoms within the year of observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*—Continued

Diagnosis and International List numbers, 1920 revision	Number of cases with known duration of symptoms	Percent of cases with the specified total duration of symptoms, in days during the year of observation: All cases of known duration	Less than 3	3-5	6-8	9-11	12-17	18-24	25-45	46-75	76-365
Nervous diseases except cerebral hemorrhage, paralysis, neuralgia, and neuritis:											
Nervousness (pt. 81)	190	100	4.2	14.2	10.5	4.7	10.0	10.5	14.7	7.9	23.2
Neurasthenia, nervous breakdown (pt. 84)	97	100	4.1	3.1	10.3	5.2	9.3	4.1	12.4	16.5	35.1
Other nervous diseases except cerebral hemorrhage, paralysis, neuralgia, neuritis and convulsions (70–73, 76–78, 81, pt. 84)	107	100	6.5	4.7	2.8	2.8	3.7	2.8	6.5	1.9	68.2
Rheumatism and related diseases:											
Chronic rheumatism and arthritis (pt. 52)	128	100	.8	1.6	4.7	2.3	4.7	2.3	9.4	3.9	70.3
Rheumatism, unqualified (pt. 52)	189	100	1.6	9.5	15.9	10.1	20.6	15.9	14.8	4.2	7.4
Neuralgia and neuritis (82)	226	100	8.8	13.7	11.5	9.3	11.1	5.8	14.2	4.9	20.8
Lumbago (pt. 158)	118	100	1.7	20.3	23.0	11.9	20.3	7.6	7.6	5.1	3.4
Degenerative diseases:											
Benign tumors, except of female organs (50)	98	100	15.3	9.2	13.3	10.2	8.2	8.2	15.3	5.1	15.3
Diabetes (57)	56	100	----	--	1.8	1.8			1.8	3.6	91.1
Diseases of heart (87-90)	194	100	7.2	6.2	10.8	2.6	6.7	3.1	5.7	5.7	52.1
Arteriosclerosis and high blood pressure (pt. 91, pt. 96)	95	100	2.2	2.1	5.3	2.1	6.3	4.2	11.6	2.1	64.2
Other and unspecified kidney diseases except pyelitis (pt. 131)	124	100	3.2	12.1	13.7	11.3	14.5	11.3	13.7	2.4	17.7
Cystitis, and calculi of urinary passages (132, pt. 133)	125	100	4.0	14.4	19.2	6.4	16.0	11.2	10.4	3.2	15.2
Other diseases of bladder (pt. 133)	54	100	11.1	9.3	9.3	3.7	11.1	13.0	20.4	----	22.2
Skin diseases:											
Furuncle (152)	294	100	1.4	13.6	21.4	13.6	17.7	11.6	12.6	4.4	3.7
Abscesses and ulcers (153, pt. 154)	111	100	2.7	6.3	25.2	17.1	14.4	9.0	15.3	6.3	2.7
Impetigo (pt. 151)	130	100	------	10.8	20.0	10.0	16.9	14.6	19.2	5.4	3.1
Urticaria, hives (pt. 154)	61	100	23.0	26.2	18.0	4.9	13.1	6.6	1.6		6.6
Scabies (pt. 154)	92	100	----	13.0	14.1	9.8	14.1	15.2	17.4	9.8	6.5
Eczema (pt. 154)	134	100	2.2	3.0	3.7	3.7	10.4	6.7	20.1	6.0	44.0
Other and ill-defined skin diseases (151, pt. 154, pt. 205)	390	100	13.8	7.1	14.9	7.8	14.1	8.8	13.9	7.3	12.1
Female genital and puerperal diagnoses:											
Menstrual disorders (140, pt. 141)	180	100	18.9	17.2	14.4	5.0	11.7	6.1	6.1	3.3	17.2
Other and ill-defined nonvenereal diseases of female organs, including chronic results of childbirth (pt. 141, 142, pt. 145, pt. 149)	215	100	3.3	4.7	4.7	3.3	10.7	8.8	16.7	9.8	38.1
Abortions, miscarriages, and stillbirths (pt. 143)	133	100	1.5	3.0	15.0	19.5	21.8	16.5	15.0	6.0	1.5
Live births (pt. 145, pt. 149)	697	100	------	1.0	2.4	29.6	52.4	9.5	4.3	.3	.6
Accidental injuries:											
Poisoning by ivy, oak, and other plants (pt. 177)	96	100	2.1	21.9	41.7	9.4	11.5	8.3	5.2	---	----
Other accidental poisoning (175, 176, pt. 177)	110	100	28.2	27.3	25.5	2.7	5.5	6.4	3.6	.9	---
Automobile accidents (pt. 188)	175	100	8.6	8.0	13.1	9.1	17.7	13.1	16.6	7.4	6.3
Accidental burns (179)	139	100	9.4	14.4	22.3	9.4	20.9	12.9	10.1	----	.7
Accidental injuries by cutting or piercing instruments (184)	274	100	16.8	21.2	20.8	9.9	14.2	7.7	7.7	1.5	.4
Accidental falls (185)	174	100	10.9	21.8	16.7	6.9	17.8	9.8	8.6	4.6	2.9
Eye accidents (pt. 85, pt. 202)	98	100	38.8	22.4	13.3	8.2	8.2	1.0	5.1	1.0	2.0
All other accidents except injury by animals (165, 174, 178, 180-183, 186, 187, pt. 188, 190-200, 201, pt. 202)	1,529	100	7.9	15.9	17.0	10.1	14.4	10.7	16.1	4.2	3.9
All other diseases:											
Anemia, all forms (58)	92	100	2.2	2.2	3.3	----	7.6	2.2	10.9	15.2	56.5
Diseases of thyroid gland (60)	100	100	7.0	---	----	2.0	2.0	2.0	12.0	5.0	70.0
Acidosis (pt. 69)	55	100	1.8	25.5	21.8	10.9	18.2	5.5	5.5	7.3	3.6
Sty (pt. 85)	57	100	5.3	28.1	31.6	7.0	14.0	3.5	3.5	3.5	3.5
Conjunctivitis, pinkeye, sore eye (pt. 85)	179	100	6.1	35.2	25.7	10.6	10.6	3.9	4.5	2.2	1.1
Other eye diseases (pt. 85)	128	100	12.5	14.8	10.9	5.5	4.7	4.7	13.3	1.6	32.0
Hemorrhoids (pt. 93)	86	100	5.8	11.6	15.1	8.1	9.3	5.8	17.4	5.8	20.9
Diseases of lymphatic system (94)	165	100	3.0	18.8	17.6	9.7	19.4	11.5	12.1	4.2	3.6

TABLE 8.—*Distribution of illnesses from specific causes according to total duration of symptoms within the year of observation—8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*—Continued

Diagnosis and International List numbers, 1920 revision	Number of cases with known duration of symptoms	Percent of cases with the specified total duration of symptoms, in days, during the year of observation								
		All cases of known duration	Less than 3	3–5	6–8	9–11	12–17	18–24	25–45	46–75	76–365
All other diseases:—Cont.										
Diseases of the teeth and gums (pt. 108)	205	100	21.0	25.9	19.5	7.3	11.7	4.9	4.4	1.5	3.9
Pyelitis (pt. 131)	76	100	1.3	7.9	15.8	7.9	21.1	14.5	14.5	5.3	11.8
Circumcision (pt. 136)	54	100	5.6	35.2	37.0	11.1	7.4	3.7	----	----	----
Diseases of bones and joints except tuberculosis and rheumatism (155, 156)	68	100	5.8	5.9	7.4	1.5	5.9	4.4	11.8	4.4	52.9
Ill-defined orthopedic conditions and diseases of the organs of locomotion, except lumbago, myalgia, and myositis (157, pt. 158, pt. 205)	124	100	9.7	.8	2.4	4.0	9.7	4.0	8.9	4.0	56.5
Congenital malformations and diseases of early infancy (159–163)	61	100	24.6	11.5	1.6	----	4.9	1.6	11.5	4.9	39.3
Foot trouble (pt. 205)	74	100	93.2	----	----	----	----	1.4	1.4	----	4.1
Headache (pt. 205)	214	100	56.1	18.7	7.9	3.7	2.3	2.3	1.9	.9	6.1
Backache (pt. 205)	87	100	12.6	20.7	23.0	6.9	10.3	5.7	8.0	2.3	10.3
Debility, fatigue, exhaustion, malnutrition, loss of weight (pt. 205)	185	100	16.7	5.9	10.8	4.9	11.4	8.6	13.5	7.0	21.1
Rash, unqualified (pt. 205)	89	100	13.5	31.5	15.7	9.0	13.5	3.4	11.2	----	2.2

of symptoms the degenerative diseases show the longest duration, 109 days within the study year per case of sole diagnosis, and the minor respiratory diseases show the shortest duration of symptoms with 10 days per case.

Tables for specific diagnoses give average durations of the different types (table 2) and distributions of cases according to the durations of the various types (tables 4, 6, and 8).

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SOME DEVELOPMENTS IN THE WATER POLLUTION RESEARCH PROGRAM OF THE PUBLIC HEALTH SERVICE[1]

By J. K. Hoskins, *Senior Sanitary Engineer, United States Public Health Service, Stream Pollution Investigations Station, Cincinnati, Ohio*

The headquarters station of the Public Health Service for research in matters pertaining to water, sewage, and stream pollution, now a section of the National Institute of Health, is located at Cincinnati, Ohio. This type of research has been a gradual development of the original pollution and natural purification study of the Ohio River organized and directed by the late Dr. Wade H. Frost. The same building then occupied is still in use but enlarged activities have rendered it inadequate. An allotment of $275,000 from the general public building fund has been made for a laboratory building, construction of which will be started on a new site as soon as agreements for acquirement of the 8-acre property are consummated and plans can be completed.

The research work in which the station is engaged is concerned with sanitary problems pertaining to the uses of water, its pollution and purification. Recently the fundamental mechanism of the biochemical

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oxidation of organic matter, as it functions in biological methods of sewage treatment, has been under observation. Considerable experimental work has been completed concerning determination of the rates of oxygen withdrawal from flowing water by underlying sludge deposits. A field study of the sanitary condition of the Scioto River as affected by installation of modern methods of treatment of contributed sewage has been completed. A Nation-wide continuing census of water and sewage treatment plants has been inaugurated. The station is also conducting an extensive laboratory study of the sanitary condition of the waters of the Ohio River and its tributaries as a part of the pollution survey being undertaken jointly by the Public Health Service and the U. S. Army Engineer Corps.

Seuage treatment studies.—The primary objective of this research has been to determine the factors that impair the efficiency of the activated sludge method of sewage purification. Exploration of these interfering agencies has led to an investigation of the basic mechanism of the biological oxidation of organic matter in liquids and the conditions which stimulate or retard its progress. It has been found advisable to work with individual parts of the complex biological and biochemical principles comprising the activated sludge process and to study the functioning of some of these separate parts free from interference and under controlled environment, and then gradually to assemble these parts and observe the resulting effect. Following this procedure and employing apparatus developed for observing the rate of oxygen use (*1*) and using pure cultures obtained from individual cells isolated from activated sludge have made it possible to develop certain conclusions concerning the oxidation process.

The predominant type of organisms in activated sludge appear to belong to the zoogleal group of bacteria. These bacteria, when aerated in pure culture in a clear synthetic medium or in sterilized sewage, produce a growth which exhibits the characteristic properties of activated sludge such as flocculation, rapid settling, and clear supernatant with high rates of oxidation and total purification of the contained soluble organic matter (*2*). Following this lead, it has been possible to demonstrate the exceedingly high rate of oxidation of organic matter effected by activated sludge in comparison with the removal rate of biochemical oxygen demand (B. O. D.) regularly observed in streams or in the dilution process. It appears that the massed or clumped zoogleal bacteria maintained by proper aeration necessary for their rapid growth explains the high rate of biochemical oxidation obtained in the activated sludge process (*3*, *4*). Pursuing this line of study further, the similarity of the clarification mechanism of normal activated sludge and of that occurring with the elementary pure bacterial culture sludge has been demonstrated. Moreover, it has been possible to trace the component rates of total purification,

including the oxidation rate as distinguished from those of net adsorption and synthesis of organic matter occurring in the activated sludge process (*5*). Further studies are now in progress which appear to demonstrate the close similarity in characteristics and functions of the zoogleal bacteria as obtained from activated sludge flocs and from the slime coatings of sewage sprinkling filters.

The problem of developing some practicable method for ascertaining quickly the condition of activated sludge by the plant operator has been given consideration. The B. O. D. reduction test appears to be an insensitive indicator of the change in purification capacity of activated sludge. The quantity of oxygen used per gram of suspended matter during a short aeration period of the sewage-sludge mixture was found to be a better index of activated sludge condition (*6*).

Aside from devices for observing the rate of oxygen used, determination of the capacity of activated sludge for glucose removal from the substrate appears to offer some promise as a sludge index, as well as an explanation of the mechanism of removal of soluble organic constituents in sewage. Studies of the ash content of both pure culture zoogleal and normal activated sludge have indicated no definite relation between ash volume or composition and oxidation or total purification capacities.

The relationship of fungus growths of the *Sphaerotilus* type to sludge bulking are being studied. Our observations appear to indicate that *Sphaerotilus* requires very little oxygen for its growth, is therefore of small value as an oxidizing agent, and flourishes best when conditions detrimental to the normal growth and functioning of the zoogleal bacteria prevail in the sludge-sewage mixture. The previous work of Ruchhoft has been confirmed concerning the stimulation of *Sphaerotilus* growth afforded by carbohydrates in the sewage liquor. Results indicate that this growth stimulation is not directly proportional to the amount of mono- or di-saccharoses present, but is an indirect stimulus by a substance or substances present when excessive amounts of carbohydrate material upset the usual biological balance in normal activated sludge.

In research of this nature, development of suitable methods and exploration of incidental observations are generally necessary and profitable. Thus, it has been determined that the modified azide procedure (*7*) is of value in increasing the accuracy of the B. O. D. test in the presence of nitrites. It has also been discovered that the Winkler method for determination of the B. O. D. of river muds may be quite inaccurate owing to interference of contained substances such as insoluble sulfides with the reagents but that many of these interfering compounds can be removed by coagulation previous to beginning the test for dissolved oxygen. Again, the dissolved

oxygen saturation value of sewage was found to be approximately equal to that of clear water (*8*).

Stream oxidation study.—Experimental studies have been in progress over a considerable period designed to develop practical methods for evaluation of the capacities of flowing streams for natural oxidation of sewage and other organic wastes. Past studies have shown that the rate of natural oxidation of organic materials in solution and suspension in a natural body of water can be measured directly by the ordinary B. O. D. test of representative samples. The most uncertain element is the oxygen demand exerted by underlying sludge deposits which are not included in the water sample and are for this reason extremely difficult to measure, both as to their extent and their rates of oxidation under the conditions in which they exist naturally. Starting with the development of a rational method for calculating the deoxygenating effect of sludge deposits based upon observations of the B. O. D. of the supernatant water (*9*) and proceeding to the explanation of formulae by which rates of oxidation and reaeration and the trend of the resultant oxygen curve may be calculated from observations of progressive changes in the biochemical oxygen demand and dissolved oxygen content of a polluted stream (*10*) the results of experimental work have been presented showing the effect of various factors on the oxygen depletion and reaeration rates occurring (*11*). Later direct experimental evidence on the oxidation rates of river bottom sediments now awaits critical analysis and publication. A complementary study has indicated that the rates of reaeration of sewage-polluted streams particularly when flowing at higher velocities are materially lower than reaeration rates of unpolluted waters (*12*).

Scioto River study.—The evaluation of sewage treatment in definite terms of stream improvement has been the objective of a comprehensive field study of the sanitary condition of the Scioto River in Ohio during the past 2 years or more. The city of Columbus discharges its liquid wastes into the Scioto River. The original sewage treatment plant was entirely inadequate and obsolete and has been recently replaced by a modern one of the activated sludge type. Observations of the bacteriological, biological, and biochemical condition of the river waters and channel sediments were undertaken for a complete year throughout the 100-mile river stretch below Columbus, both prior to and following completion of the new sewage treatment works. The extensive analytical data are now being assembled and critically analysed in preparation for publication of the results obtained and the conclusions possible to be drawn. A preliminary review of the data indicates that although the old Imhoff tank sprinkling filter plant was entirely inadequate, the effect of this effluent on the river was not so detrimental as that discharged from the new

plant when plain sedimentation only was employed during the first few months of its operation. However, when complete activated sludge treatment was begun, a profound improvement in the sanitary condition of the stream promptly occurred. This improvement was definitely reflected in the bacteriological and plankton content and biochemical reactions of the water as well as in the animal life in the bottom sediments. Some incidental observations pertaining to stream biology and the verification of certain organisms as pollution indicators have been published (*13*, *14*, *15*).

Inventory of water and sewage treatment plants.—Although the recently inaugurated continuing census of water and sewage treatment plants and stream pollution conditions throughout the United States is not a strictly fundamental research activity, it is intended to serve as a useful tool to locate problems in these fields and record progress made in their solution as well as to serve as an aid to the engineering divisions of State health departments. Work is in progress on the collection of basic data on each individual plant. As soon as sufficient data have been made available by the States, it is proposed to summarize them for publication and to revise such publications periodically. It is hoped that eventually the Public Health Service may act as a clearing house for the exchange of such information and thereby relieve the individual States of some requests for data of this nature.

Ohio River pollution survey.—Legislation enacted by the 75th Congress, first session, directed the Secretary of War to have made a comprehensive survey of the pollution of the Ohio River and its tributaries for determination of necessary corrective measures. Provision was also made for obtaining the cooperation and assistance of the Public Health Service in this activity. This survey is now being carried on jointly by the U. S. Engineer Corps and the Public Health Service. To the Stream Pollution Investigations Station has been assigned the direction and conduct of all analytical work of the survey. Although this assignment is not primarily one of research, but rather one of fact finding, it does afford some possibilities of employing the assembled data for critical study. The central third of the watershed at present under observation extends from the mouth of the Kanawha at Point Pleasant, W. Va., to the mouth of the Kentucky at Carrollton, Ky., including the tributaries within this river stretch of about 280 miles, and comprises a watershed area of over 30,000 square miles. It is proposed to cover the upper section of the watershed in 1940 and the lower third in 1941.

The central laboratory for this field study is located at Cincinnati, to which point samples are brought by motorboats and automobiles from accessible main river sampling stations and tributaries. The upper section of this river stretch and tributary area is served similarly by a completely equipped floating laboratory. The fringes

of the watershed not readily accessible to the two large laboratories are being covered by mobile laboratory units moving from place to place. Coincidental with the analytical work, the Public Health Service is collecting detailed data pertaining to the sources, nature, and extent of pollution contributed throughout the watershed.

A supplementary part of this Ohio River study is an epidemiological and bacteriological investigation now in progress of the endemic and epidemic occurrence of intestinal disorders which may be water-borne. Such outbreaks of undetermined origin are occurring with increasing frequency and while many of them have certain characteristics which cast suspicion on the drinking-water supply, the causative factors are frequently obscure.

Miscellaneous activities.—In the conduct of any research program opportunities are always presented for exploring some interesting problems more or less directly related to the main objectives. In our bacteriological laboratories the enumeration of the coliform group of organisms in water samples comprises an appreciable portion of the routine work. The possibility of making direct counts of this group on some solid differential medium is being investigated. The results of such plate counts on duplicate samples from a large variety of sources are being correlated with those obtained by the standard methods dilution procedure. The data thus far accumulated appear to indicate that the direct counts on brilliant green lactose bile agar are sufficiently accurate to justify serious consideration of this shortened procedure when the density of coliforms in the sample is sufficient to provide for accurate plate counts.

In the coverage of certain parts of the Ohio River watershed an opportunity was afforded to explore the plankton life existing in the acid mine waters draining from coal mines. It was found that such microscopic life was restricted to only a few specific forms (*16, 17*).

The methods of preparation of plankton specimens for microscopic examination and the changes in appearance of some of them induced by formalin used for their preservation has also been the subject of a separate publication (*18*). Another interesting study has been an endeavor to evaluate the contribution of dissolved oxygen contributed to water by a definite species of algae (*19*).

The results of the research work of the station are generally published in the PUBLIC HEALTH REPORTS and are usually available in the form of reprints. Certain of the technical papers pertaining to sewage research are printed simultaneously in the Sewage Works Journal or separately in appropriate professional journals.

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VIABILITY OF *AËDES AEGYPTI* EGGS

By JAMES H. LE VAN, *Passed Assistant Sanitary Engineer, United States Public Health Service*

Aëdes aegypti eggs laid on June 12, 1938, in four small wooden troughs containing water were put aside and were not disturbed for exactly one year's time. The troughs were kept in the humid air of the insectary. On June 12, 1939, these egg troughs were immersed in tap water. A few larvae hatched out from two of the troughs. Hatching was slightly delayed. Several larvae that were set aside were reared through to the adult stage.

The experiment was carried out in the insectary of the Aëdes Aegypti Control Unit attached to the Miami, Fla., Quarantine Station. It was begun by Sanitary Engineer H. A. Johnson when he was stationed in Miami and was completed by the author. The care of the egg troughs was entrusted to Attendant Jacob M. Detzel.

CONCLUSION

This experiment disclosed that it is possible for *Aedes aegypti* mosquito eggs to remain viable in the vicinity of Miami, Fla., for at least one year. No freezing weather occurred during the experimental period.

THE THIRTY-EIGHTH ANNUAL CONFERENCE OF STATE AND TERRITORIAL HEALTH OFFICERS

The thirty-eighth annual conference of State and Territorial Health Officers with the Surgeon General of the Public Health Service was held in Washington, D. C., on May 9, coming between the sessions of the conference of State and Provincial Health Officers, which met on May 8, 10, and 11.

The conference this year was strictly an executive meeting, with attendance limited to State health officers and administrative officers of the Public Health Service and the Children's Bureau who are directly responsible for the activities relating to State's relations. This restriction was made because of an expressed desire on the part of the State health officers and the practical necessity of accomplishing in a single day the work of the conference dealing with the manifold topics listed for discussion and the exchange of counsel on matters of health administration.

The conference was called to order by the Surgeon General. Mr. Wayne Coy, Assistant Administrator of the Federal Security Agency, representing Administrator Paul V. McNutt, gave the speech of welcome.

In his prefatory remarks the Surgeon General mentioned briefly several of the problems which confront public health administrators in general and which should be given attention. Among the most important of these are the extension of the areas of known plague infection in the western States, endemic typhus fever in the South, the potential danger from yellow fever as the result of increasing airplane travel, the lack of vaccination against smallpox, nutrition, industrial hygiene, housing and health, stream sanitation, hospital facilities, health insurance, medical care, programs for special diseases, the increasing importance of the chronic diseases of the older age groups and the need for adopting measures against these disorders for which the usual preventive measures that characterize long-established programs of health departments are not especially applicable. The Surgeon General mentioned the reorganization and coordination of Government agencies concerned primarily with health, education, and public welfare, and internal coordination through common service units, conference committees, and the assignment of personnel across division lines. He suggested that there is reason to believe that this pattern of organization will also find expression in State and local health services.

The annual conferences of State and Territorial Health Officers are held in accordance with the act of July 1, 1902. The first conference met in Washington on June 3, 1903, at which 22 States and Territories were represented. These meetings have developed a spirit of harmony and cooperation between the State and National Governments in matters of public health which has been of great value in developing a more closely integrated national health program under recent Federal Legislation.

At the recent meeting, it was agreed that the next conference should be executive in character. The date and place of meeting will be determined later.

COURT DECISION ON PUBLIC HEALTH

Employee held not to have suffered "injury" within meaning of workmen's compensation law.—(United States Circuit Court of Appeals, 5th Circuit; *Lux* v. *Western Casualty Co.*, 107 F.2d 1002; decided December 7, 1939.) In a suit by a widow to secure compensation under the Texas workmen's compensation law for the death of her husband it appeared that the deceased, a packing house employee, had to pass back and forth from a high temperature in the smokehouse to a near freezing temperature in the cooling room, that he was furnished a supposedly waterproof apron which was defective, and that he got wet through it and took a cold which passed into fatal pneumonia.

The compensation law granted compensation only for injury suffered in the course of employment and declared that "injury" should be construed to mean "damage or harm to the physical structure of the body and such diseases or infection as naturally result therefrom." The appellate court denied compensation, saying that for one merely to get wet or to pass from one commonly experienced temperature to another was not an "injury" as no damage to the physical structure of the body was done thereby. "Although," said the court, "a cold or pneumonia may naturally follow and may itself do damage to the physical structure of the body, it remains true that there was no initial industrial injury. Such infections and diseases can be added to an 'injury,' but they cannot substitute it under the statutory definition."

DEATHS DURING WEEK ENDED APRIL 27, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Apr. 27, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,486	8,680
Average for 3 prior years	8,689	
Total deaths, first 17 weeks of year	158,257	158,639
Deaths under 1 year of age	523	500
Average for 3 prior years	502	
Deaths under 1 year of age, first 17 weeks of year	8,721	9,258
Data from industrial insurance companies:		
Policies in force	65,664,534	67,385,436
Number of death claims	13,544	15,976
Death claims per 1,000 policies in force, annual rate	10.8	12.4
Death claims per 1,000 policies, first 17 weeks of year, annual rate	10.7	11.7

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MAY 11, 1940

Summary

For the country as a whole no unusual incidence is shown for the current week in the communicable diseases reported weekly by the State health officers. The figures for each of the nine diseases included in the following table, with the exception of influenza, were below the 5-year (1935–39) median expectancy.

Kentucky reported 12 cases of meningococcus meningitis, as compared with 3 cases for the preceding week, but no other State reported more than 4 cases. The number of reported cases of smallpox dropped from 95 for the preceding week to 48, of which 13 cases occurred in Iowa. Sixteen cases of Rocky Mountain spotted fever were reported, of which 15 occurred in 5 northwestern States and 1 case in Maryland. Of 17 cases of endemic typhus fever, 6 were reported in Georgia and 5 in Texas.

For the week ended May 11, the number of deaths in 88 large cities, as reported to the Bureau of the Census, was 8,617, as compared with 8,459 for the preceding week and with a 3-year average (1937–39) of 8,370. The total number of deaths for the first 19 weeks of the current year is 175,331 as compared with 175,368 for the corresponding period last year and with a cumulative 3-year weekly average to date of 176,806. The infant mortality in these cities for the current week was 518, as compared with 496 for the preceding week and with a 3-year average of 509, while the cumulative total for the first 19 weeks of this year is 9,716, as compared with 10,252 for the same period last year.

Telegraphic morbidity reports from State health officers for the week ended May 11, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939	
NEW ENG.												
Maine	0	1	1	1	44	1	454	140	134	0	0	0
New Hampshire	0	0	0	-------	-------	-------	38	1	23	0	0	0
Vermont	0	0	1	-------	-------	-------	12	142	142	0	0	0
Massachusetts	4	7	7	-------	-------	-------	713	1,048	763	1	1	2
Rhode Island	0	1	0	-------	-------	-------	159	93	76	0	0	0
Connecticut	2	0	5	1	2	1	54	1,129	333	0	0	1
MID. ATL.												
New York	23	26	38	[1] 16	[1] 12	[1] 8	945	2,320	3,027	4	4	6
New Jersey	6	9	14	5	4	7	759	66	934	0	0	2
Pennsylvania	20	30	28	-------	-------	-------	417	135	1,530	4	8	7
E. NO. CEN.												
Ohio	17	9	20	44	-------	26	22	40	1,544	1	2	5
Indiana	1	7	9	6	8	11	22	14	376	0	0	3
Illinois	17	32	36	7	77	30	198	43	296	1	2	3
Michigan [2]	3	20	8	7	10	-------	661	481	481	0	1	3
Wisconsin	2	1	2	65	79	32	770	903	903	0	0	0
W. NO. CEN.												
Minnesota	1	2	2	2	3	2	135	293	293	0	0	1
Iowa	3	1	4	-------	5	3	260	147	147	0	0	0
Missouri	12	1	16	2	2	32	24	7	41	2	0	3
North Dakota	0	2	1	6	37	15	5	90	30	0	1	0
South Dakota	1	0	0	1	5	-------	1	233	4	0	0	0
Nebraska	1	2	3	-------	4	1	23	399	215	0	0	0
Kansas	6	5	8	3	5	4	509	83	83	2	0	2
SO. ATL.												
Delaware	0	2	1	-------	-------	-------	0	9	19	0	0	0
Maryland [2][3]	0	1	6	2	-------	8	5	241	241	0	1	2
Dist. of Col.	4	6	6	-------	-------	-------	5	312	104	0	0	1
Virginia	9	8	9	114	154	-------	298	760	496	3	0	6
West Virginia [3]	4	4	4	20	23	27	88	2	76	3	1	5
North Carolina	5	3	12	-------	6	6	227	356	257	2	2	2
South Carolina [4]	2	6	6	303	389	115	38	22	74	0	1	1
Georgia [4]	4	11	8	56	117	-------	144	74	-------	1	0	2
Florida [4]	1	1	6	1	41	4	166	154	50	0	1	1
E. SO. CEN.												
Kentucky	4	10	9	12	3	9	120	47	280	12	2	6
Tennessee	2	2	7	42	77	77	181	105	105	2	0	4
Alabama [4]	3	4	8	47	199	51	103	149	149	0	2	2
Mississippi [3]	5	2	5	-------	-------	-------	-------	-------	-------	2	1	0
W. SO. CEN.												
Arkansas	3	6	6	46	96	70	120	55	55	0	0	1
Louisiana [4]	3	8	11	3	8	15	11	67	63	0	2	2
Oklahoma	5	10	5	40	111	51	13	305	60	0	0	1
Texas [4]	26	13	28	335	402	230	1,574	506	450	3	3	3
MOUNTAIN												
Montana [3]	2	2	1	31	82	2	57	626	42	0	0	0
Idaho [3]	0	0	0	-------	1	6	33	83	22	1	0	0
Wyoming [3]	0	1	1	1	-------	-------	14	60	28	0	1	0
Colorado [4]	3	14	7	4	4	-------	47	424	299	1	0	1
New Mexico	0	1	2	11	6	5	63	13	38	0	0	0
Arizona	1	0	1	73	39	35	73	22	22	0	0	0
Utah [2][3]	0	0	0	3	13	-------	635	86	40	0	0	0

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 11, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939	
PACIFIC												
Washington	0	1	1	1			659	1,235	330	0	0	2
Oregon [3]	5	0	2	12	50	30	572	67	67	0	0	0
California	17	16	24	63	53	53	373	2,213	1,682	0	1	3
Total	227	288	386	1,386	2,121	950	11,806	15,800	15,800	45	37	115
19 weeks	6,412	8,468	10,035	162,162	143,546	132,715	130,147	258,610	258,610	759	931	2,604

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939	
NEW ENG.												
Maine	0	0	0	9	5	11	0	0	0	0	1	1
New Hampshire	0	0	0	1	5	7	0	0	0	0	0	0
Vermont	0	0	0	4	10	9	0	0	0	0	4	0
Massachusetts	0	0	0	153	191	233	0	0	0	4	1	1
Rhode Island	0	0	0	8	13	13	0	0	0	0	0	0
Connecticut	0	0	0	106	65	108	0	0	0	2	1	1
MID. ATL.												
New York	0	1	0	1,091	572	904	0	0	0	6	7	7
New Jersey	0	1	0	419	261	241	0	0	0	2	3	1
Pennsylvania	1	0	1	467	327	351	0	0	0	7	5	8
E. NO. CEN.												
Ohio	0	1	0	380	371	371	0	18	0	4	2	5
Indiana	0	0	0	107	158	120	1	52	21	0	3	2
Illinois	1	2	0	676	420	575	2	11	18	2	3	6
Michigan [3]	0	0	1	335	350	309	2	25	0	1	2	2
Wisconsin	1	0	0	131	146	285	1	4	5	2	2	1
W. NO. CEN.												
Minnesota	0	0	0	56	61	163	1	4	8	1	1	2
Iowa	0	0	0	61	75	91	13	45	31	1	6	2
Missouri	0	0	0	65	64	64	7	43	1	1	0	2
North Dakota	0	0	0	2	6	36	2	0	5	0	1	0
South Dakota	0	1	0	7	16	16	1	7	7	0	0	0
Nebraska	0	0	0	24	23	76	4	6	7	0	0	0
Kansas	1	0	0	55	54	83	0	4	11	3	0	1
SO. ATL.												
Delaware	0	0	0	5	2	3	0	0	0	0	0	0
Maryland [2 3]	0	0	0	28	32	46	0	0	0	1	1	2
Dist. of Col.	0	0	0	47	12	17	0	0	0	0	0	0
Virginia	0	0	0	30	16	21	0	0	0	4	2	6
West Virginia [3]	2	0	0	27	18	32	0	0	0	2	1	4
North Carolina	0	1	1	20	17	22	0	0	0	2	2	3
South Carolina [4]	1	22	0	3	0	3	1	0	0	2	7	8
Georgia [4]	1	5	0	11	7	7	0	1	0	3	5	9
Florida [4]	0	6	1	6	8	7	0	0	0	1	4	4

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 11, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939		May 11, 1940	May 13, 1939	
E. SO. CEN.												
Kentucky	0	0	0	70	48	38	0	3	1	8	2	4
Tennessee	0	0	0	55	57	20	0	2	1	0	6	3
Alabama [4]	0	1	1	8	4	6	0	0	0	5	5	4
Mississippi [2]	0	1	1	3	1	5	0	2	0	1	3	3
W. SO. CEN.												
Arkansas	0	0	0	13	7	7	0	14	1	6	4	2
Louisiana [4]	0	1	0	5	10	10	0	0	0	1	12	12
Oklahoma	0	0	0	15	23	21	1	40	2	1	9	3
Texas [4]	1	0	1	24	37	63	2	5	5	9	13	7
MOUNTAIN												
Montana [3]	0	0	0	21	29	17	0	2	0	2	1	0
Idaho [3]	0	0	0	5	9	9	0	0	1	1	0	0
Wyoming [3]	0	0	0	14	2	7	0	0	5	0	0	0
Colorado [5]	0	0	0	34	47	47	7	5	5	1	1	1
New Mexico	0	0	0	4	13	21	0	1	0	0	1	1
Arizona	0	0	0	15	7	16	0	9	0	2	2	1
Utah [2 3]	0	0	0	16	21	21	1	2	0	0	0	0
PACIFIC												
Washington	0	0	0	55	38	38	1	1	9	2	3	3
Oregon [3]	0	1	0	17	18	37	0	22	19	0	1	1
California	5	3	3	143	147	197	1	4	18	9	8	8
Total	14	47	22	4,887	3,823	5,783	48	332	272	99	134	134
19 weeks	439	371	375	91,674	94,223	129,276	1,380	6,778	5,987	1,560	2,210	2,210

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 11, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended May 11, 1940	Whooping cough, Week ended May 13, 1939
NEW ENG.		
Maine	8	49
New Hampshire	32	2
Vermont	37	62
Massachusetts	170	204
Rhode Island	4	96
Connecticut	27	100
MID. ATL.		
New York	346	481
New Jersey	114	272
Pennsylvania	313	307
E. NO. CEN.		
Ohio	218	220
Indiana	26	55
Illinois	95	229
Michigan [2]	109	172
Wisconsin	94	138
W. NO. CEN.		
Minnesota	36	30
Iowa	26	19
Missouri	44	23
North Dakota	11	5
South Dakota	0	0
Nebraska	16	6
Kansas	39	28
SO. ATL.		
Delaware	1	11
Maryland [2] [3]	125	14
Dist. of Col.	12	33
Virginia	48	40
West Virginia [2]	85	20
North Carolina	109	230
South Carolina [4]	23	96
Georgia [4]	25	56
Florida [4]	12	45
E. SO. CEN.		
Kentucky	78	13
Tennessee	62	40
Alabama [4]	18	35
Mississippi [2]	--------	--------
W. SO. CEN.		
Arkansas	19	21
Louisiana [4]	31	10
Oklahoma	8	14
Texas [4]	344	175
MOUNTAIN		
Montana [3]	1	4
Idaho [3]	20	5
Wyoming [3]	6	6
Colorado [5]	16	68
New Mexico	62	46
Arizona	38	8
Utah [2] [3]	190	76
PACIFIC		
Washington	49	27
Oregon [3]	29	36
California	479	190
Total	3,754	3,820
19 weeks	58,956	76,445

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Rocky Mountain spotted fever, week ended May 11, 1940, 16 cases as follows: Maryland, 1; Montana, 2; Idaho, 3; Wyoming, 5; Utah, 3; Oregon, 2.
[4] Typhus fever, week ended May 11, 1940, 17 cases as follows: South Carolina, 2; Georgia, 6; Florida, 1; Alabama, 1; Louisiana, 2; Texas, 5.
[5] Colorado tick fever, week ended May 11, 1940, Colorado, 3 cases.

PLAGUE INFECTION IN FLEAS AND GROUND SQUIRRELS IN ELKO COUNTY, NEVADA

Under date of May 1, 1940, Surgeon L. B. Byington reported plague infection found in tissue from 2 ground squirrels, *C. beldingi oregonus*, found dead on April 18 on ranches 6 and 10 miles, respectively, northeast of Lamoille; in a pool of 20 fleas from 6 ground squirrels of the same species, shot on the same date, on a ranch 8 miles northeast of Lamoille; and in tissue from 1 ground squirrel, *C. richardsoni nevadensis*, also shot on April 18, on a ranch 5 miles west of Wells. All localities are in Elko County, Nevada.

WEEKLY REPORTS FROM CITIES

City reports for week ended Apr. 27, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	138	170	60	7,140	686	2,242	21	403	23	1,248	--------
Current week [1]	55	93	36	2,737	436	2,087	8	354	15	1,053	--------
Maine:											
Portland	0	------	0	178	2	0	0	0	0	2	31
New Hampshire:											
Concord	0	------	0	0	2	0	0	1	0	0	12
Manchester	0	------	0	0	1	0	0	0	0	0	10
Nashua	0	------	0	4	0	0	0	0	0	0	9
Vermont:											
Barre	0	------	0	4	0	1	0	0	0	3	1
Burlington	0	------	0	0	0	0	0	0	0	2	7
Rutland	0	------	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	0	------	1	137	18	40	0	14	0	72	246
Fall River	0	------	1	53	1	0	0	3	0	4	32
Springfield	0	------	0	4	0	6	0	1	0	1	32
Worcester	0	------	0	41	4	4	0	1	0	0	54
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	19
Providence	2	------	1	81	2	5	0	0	0	9	66
Connecticut:											
Bridgeport	0	1	1	0	0	0	0	0	1	0	33
Hartford	0	------	0	0	1	18	0	0	0	2	40
New Haven	0	1	0	0	1	2	0	1	0	2	36
New York:											
Buffalo	0	------	0	1	8	15	0	8	0	2	124
New York	20	16	2	180	74	702	0	76	4	122	1,453
Rochester	4	1	0	8	4	13	0	1	0	19	70
Syracuse	0	------	0	0	5	7	0	0	0	1	45
New Jersey:											
Camden	0	------	0	0	1	8	0	1	0	3	30
Newark	0	------	0	403	10	27	0	15	1	22	119
Trenton	0	------	0	0	2	7	0	1	0	0	34
Pennsylvania:											
Philadelphia	0	3	2	91	14	129	0	24	0	20	481
Pittsburgh	0	1	0	3	13	33	0	12	1	9	164
Reading	0	------	1	1	2	0	0	1	0	10	23
Scranton	1	------	--------	0	-------	0	0	-------	0	0	--------
Ohio:											
Cincinnati	1	------	0	2	6	13	0	3	0	15	144
Cleveland	0	10	0	5	8	45	0	7	1	30	175
Columbus	1	1	1	2	4	11	0	0	0	6	95
Toledo	0	------	0	2	5	30	0	3	0	8	68
Indiana:											
Anderson	0	------	0	1	0	3	0	0	0	3	9
Fort Wayne	0	------	1	3	2	5	0	0	0	3	81
Indianapolis	2	------	1	2	11	17	0	6	0	18	129
Muncie	0	------	0	0	2	1	1	0	0	1	18
South Bend	0	------	0	0	0	0	0	1	0	1	18
Terre Haute	0	------	0	0	1	2	1	0	0	1	30
Illinois:											
Alton	0	------	0	0	0	3	0	0	0	4	6
Chicago	2	2	1	58	42	578	0	29	2	87	698
Elgin	0	------	0	0	1	1	0	0	0	0	5
Moline	0	------	0	3	0	0	0	0	0	0	7
Springfield	0	------	0	0	7	1	0	1	0	0	33
Michigan:											
Detroit	0	2	1	111	8	75	0	15	0	81	257
Flint	0	------	0	8	4	16	0	0	0	18	19
Grand Rapids	0	------	0	5	1	18	0	1	0	17	32
Wisconsin:											
Kenosha	0	------	0	58	2	1	0	0	0	0	14
Madison	0	------	0	9	-------	3	0	0	0	6	24
Milwaukee	0	------	0	65	9	15	0	2	0	0	108
Racine	0	------	0	0	0	5	0	0	0	4	11
Superior	0	------	0	66	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[1] Figures for Little Rock estimated; report not received.

City reports for week ended Apr. 27, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Minnesota:											
Duluth	0	------	0	23	1	4	0	0	0	0	23
Minneapolis	0	------	0	4	2	20	0	1	0	3	93
St. Paul	0	------	0	1	13	8	0	0	0	7	68
Iowa:											
Cedar Rapids	0	------	--------	34	-------	1	0	-------	0	3	--------
Davenport	0	------	--------	19	-------	5	1	-------	0	0	--------
Des Moines	0	------	0	15	0	8	3	0	0	0	31
Sioux City	0	------	--------	0	-------	0	0	-------	0	0	--------
Waterloo	0	------	--------	7	-------	3	0	-------	0	1	--------
Missouri:											
Kansas City	0	------	1	3	0	15	0	5	0	0	101
St. Joseph	1	------	0	0	2	2	0	0	0	0	27
St. Louis	1	2	0	1	7	27	0	11	1	7	200
North Dakota:											
Fargo	0	------	0	0	2	0	1	0	0	0	6
Grand Forks	0	------	--------	0	-------	0	0	-------	0	0	--------
Minot	0	------	0	0	0	0	0	0	0	0	8
South Dakota:											
Aberdeen	0	------	--------	0	-------	0	1	-------	0	1	--------
Nebraska:											
Lincoln	0	------	--------	2	-------	3	0	-------	0	1	--------
Omaha	0	------	0	13	2	9	0	4	0	2	61
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	3
Topeka	0	------	0	21	4	8	0	1	0	0	22
Wichita	0	------	0	29	5	2	0	0	0	10	29
Delaware:											
Wilmington	0	------	0	0	0	5	0	1	0	4	22
Maryland:											
Baltimore	1	2	2	1	24	13	0	7	1	123	226
Cumberland	0	------	0	0	0	0	0	0	0	0	15
Frederick	0	------	0	0	0	1	0	0	0	0	4
District of Columbia:											
Washington	1	------	0	1	12	30	0	11	0	7	198
Virginia:											
Lynchburg	0	------	0	0	0	1	0	1	0	15	13
Norfolk	0	20	0	50	3	4	0	3	0	8	82
Richmond	0	------	0	0	4	1	0	2	0	0	54
Roanoke	0	------	0	16	1	2	0	0	0	0	12
West Virginia:											
Charleston	0	------	0	0	1	1	0	0	1	0	16
Huntington	1	------	--------	0	-------	6	0	-------	0	0	--------
Wheeling	0	------	0	0	1	1	0	0	0	0	24
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	-------	0	0	--------
Raleigh	1	------	0	0	3	0	0	1	0	6	11
Wilmington	0	------	0	0	0	1	0	0	0	0	9
Winston-Salem	0	------	0	0	2	4	0	1	0	0	21
South Carolina:											
Charleston	1	15	0	0	1	0	0	0	0	0	20
Florence	0	------	0	0	1	0	0	0	0	0	17
Greenville	0	------	0	0	2	0	0	0	0	1	10
Georgia:											
Atlanta	1	3	1	5	3	1	0	9	0	0	75
Brunswick	0	------	0	0	0	0	0	0	0	0	1
Savannah	0	3	1	0	0	1	0	3	0	0	27
Florida:											
Miami	0	2	0	0	2	0	0	3	0	0	45
Tampa	0	------	0	45	0	1	0	1	0	1	29
Kentucky:											
Ashland	1	2	0	0	0	3	0	0	0	0	4
Covington	0	------	0	5	0	2	0	2	0	0	12
Lexington	0	------	0	12	1	0	0	0	0	4	16
Louisville	0	1	0	4	2	34	0	3	0	46	78
Tennessee:											
Knoxville	1	------	0	1	2	8	0	1	0	3	30
Memphis	0	2	3	24	3	24	0	7	0	14	94
Nashville	0	------	0	3	5	6	0	4	0	2	36
Alabama:											
Birmingham	0	2	0	3	3	4	0	6	0	2	75
Mobile	0	------	3	0	2	0	0	0	0	0	27
Montgomery	1	1	--------	0	-------	1	0	-------	0	0	--------

See footnotes at end of table.

City reports for week ended Apr. 27, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0			0		0	0		0	0	
Little Rock											
Louisiana:											
Lake Charles	0		0	0	0	0	0	0	0	0	5
New Orleans	0	1	1	12	8	5	0	11	0	61	120
Shreveport	0		0	0	1	0	0	2	1	0	34
Oklahoma:											
Oklahoma City	0		1	2	4	0	0	0	1	7	42
Tulsa	0			2		2	0		0	19	
Texas:											
Dallas	4	1	1	267	3	1	0	3	0	28	69
Fort Worth	0		0	5	3	0	0	0	0	34	24
Galveston	0		0	4	3	0	0	1	0	0	8
Houston	2	2	0	13	4	2	0	5	0	6	67
San Antonio	0		2	10	10	0	0	3	0	0	76
Montana:											
Billings	0		0	0	0	0	0	0	0	0	13
Great Falls	0		0	8	1	3	0	0	0	0	6
Helena	0		0	1	0	1	0	0	0	0	3
Missoula	0		0	0	0	0	0	0	0	0	8
Idaho:											
Boise	0		0	0	1	0	0	0	0	0	9
Colorado:											
Colorado Springs	0		0	0	2	3	0	4	0	0	20
Denver	7		1	14	8	6	0	5	0	0	78
Pueblo	0		1	5	5	4	0	0	0	0	15
New Mexico:											
Albuquerque	0		0	0	0	0	0	5	0	18	16
Utah:											
Salt Lake City	0		0	236	0	5	1	0	0	72	31
Washington:											
Seattle	0		1	343	2	4	0	3	0	25	92
Spokane	0		0	6	3	7	0	1	0	13	34
Tacoma	0		0	7	0	5	0	0	0	1	33
Oregon:											
Portland	0	1	0	180	4	1	0	2	0	3	83
Salem	0			2		0	0		0	0	
California:											
Los Angeles	1	15	4	29	4	26	0	18	1	61	349
Sacramento	0		0	13	1	4	0	1	0	28	21
San Francisco	2		0	5	7	6	0	5	0	21	182

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
New Hampshire:				South Carolina:			
Nashua	1	0	0	Florence	0	1	0
New York:				Alabama:			
Buffalo	2	1	0	Birmingham	1	0	0
New York	1	1	0	Louisiana:			
New Jersey:				Shreveport	0	1	0
Newark	1	0	0	Texas:			
Pennsylvania:				Galveston	1	0	0
Philadelphia	2	0	0	Houston	1	0	0
Illinois:				Oregon:			
Chicago	2	1	0	Portland	1	0	0
Missouri:				California:			
St. Louis	1	0	0	Los Angeles	0	0	1

Dengue.—Cases: Charleston, S. C., 1.

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Rochester, 1; St. Paul, 1; Sacramento, 1; San Francisco, 3.

Pellagra.—Cases: Boston, 2.

Typhus fever.—Cases: New York, 1; Birmingham, 1; Houston, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended April 13, 1940.—During the week ended April 13, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1	1	2						4
Chickenpox		7	1	241	339	19	11	5	95	718
Diphtheria		1		37		2	3		4	47
Dysentery				5	1					6
Influenza		26			40	1			19	86
Measles		12	1	182	361	577	256		47	1,436
Mumps				45	445	19	19		14	542
Pneumonia		7			26	4			16	53
Poliomyelitis				1						1
Scarlet fever	1	20	5	41	157	15	10	8	5	262
Trachoma									1	1
Tuberculosis		1	6	86	72	2	2	1		170
Typhoid and paratyphoid fever		1	1	25	2	5	1	2		37
Whooping cough		8		110	86	22	43	9	33	311

CUBA

Habana—Communicable diseases—4 weeks ended April 6, 1940.—During the 4 weeks ended April 6, 1940, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	15		Scarlet fever	3	
Malaria	1	1	Tuberculosis		3
Rabies	1		Typhoid fever	52	6

EGYPT

Infectious diseases—Third quarter 1939.—During the third quarter of 1939, the following cases of infectious diseases were reported in Egypt:

Disease	Cases	Disease	Cases
Anthrax	11	Mumps	277
Cerebrospinal fever	39	Poliomyelitis	1
Chickenpox	68	Puerperal septicemia	131
Dengue	1	Rabies	9
Diphtheria	493	Scarlet fever	5
Dysentery	701	Tetanus	137
Erysipelas	1,119	Tuberculosis (all forms)	1,728
Influenza	2,353	Typhoid fever	1,939
Leprosy	175	Typhus fever	392
Lethargic encephalitis	2	Undulant fever	16
Malaria	6,199	Whooping cough	242
Measles	2,927		

Vital statistics—Third quarter 1939.—The following table shows the numbers of births and deaths for the third quarter of 1939 for all places in Egypt having a health bureau:

Number of live births	56,388
Live births per 1,000 population	45.2
Number of stillbirths	1,095
Number of deaths	45,545
Deaths per 1,000 population	36.5
Deaths under 2 years of age	16,203
Deaths under 2 years of age per 1,000 live births	287
Deaths from:	
Appendicitis	63
Cancer and other malignant tumors	274
Cerebral hemorrhage, embolism, and cerebral thrombosis	667
Cirrhosis of the liver	85
Diabetes	212
Diarrhea and enteritis (under 2 years)	16,436
Deaths from—Cont.	
Diphtheria	178
Dysentery	109
Heart disease	854
Homicide	328
Influenza	18
Malaria	8
Measles	632
Nephritis	1,011
Pneumonia	3,628
Suicide	27
Syphilis	114
Tuberculosis (all forms)	522
Typhoid fever	422
Typhus fever	28
Whooping cough	14

JAMAICA

Communicable diseases—4 weeks ended March 16, 1940.—During the 4 weeks ended March 16, 1940, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Cerebrospinal meningitis		1	Leprosy		3
Chickenpox	5	9	Poliomyelitis	1	1
Diphtheria	6	2	Puerperal sepsis		2
Dysentery	12	39	Tuberculosis	31	97
Erysipelas		2	Typhoid fever	10	41

LATVIA

Vital statistics—1939—Comparative.—The following table shows the numbers of marriages, births, and deaths in Latvia for the year 1939 as compared with 1938:

	1939	1938		1939	1938
Number of marriages	18, 111	16, 735	Number of deaths	27, 894	26, 703
Number of births	36, 864	36, 386	Number of deaths per 1,000 population	13. 09	13. 42
Number of births per 1,000 population	18. 43	18. 30			

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of April 26, 1940, pages 715-740. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Senegal—Thies.—During the week ended May 4, 1940, 1 case of plague was reported in Thies, Senegal.

United States—Nevada—Elko County.—A report of plague infection in Elko County, Nevada, appears on page 907 of this issue of PUBLIC HEALTH REPORTS.

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Public Health Reports

VOLUME 55 MAY 24, 1940 NUMBER 21

IN THIS ISSUE

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FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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THE DETERMINATION OF V FACTOR IN THE URINE AND TISSUES OF NORMAL DOGS AND OF DOGS WITH BLACKTONGUE BY THE USE OF *HEMOPHILUS PARAINFLUENZAE*[1]

By MARGARET PITTMAN, *Associate Bacteriologist, and* H. F. FRASER, *Passed Assistant Surgeon, United States Public Health Service*

Fraser, Topping, and Sebrell (*1*) have shown that in the urine of dogs the excretion of a growth-promoting substance or substances for *Shigella sonnei* is influenced by the intake of nicotinic acid. Dogs suffering from blacktongue excreted relatively little, while following administration of nicotinic acid there was a marked increase in excretion. Nicotinic acid cures canine blacktongue (*2*) and is efficacious in the treatment of pellagra (*3, 4*). The amide of nicotinic acid is an essential constituent of the coenzymes, triphosphopyridine nucleotide (TPN) (*5*) and diphosphopyridine nucleotide (DPN) (*6, 7*). Lwoff and Lwoff (*8*) have shown that either of these coenzymes can replace V factor which is required for the growth of *Hemophilus parainfluenzae* (*9*) and that as little as 0.004 gamma can be detected by the use of this bacterium. Using *Hemophilus parainfluenzae*, Kohn (*10*) has shown that the V factor level of human blood can be raised by administration of nicotinic acid.

The results of a study of the excretion of V factor in the urine of dogs maintained on diets deficient in nicotinic acid and on diets containing varying amounts of nicotinic acid are presented in this communication. In addition, the determination of the V factor content of the tissues of a few dogs, normal and with blacktongue, and of several rats are given.

MATERIALS AND METHODS

Diets.—Twelve of fourteen dogs used in this study were also used in some exper, imental work on riboflavin by Fraser, Topping, and Isbell (*11*). In their report the diets are described in detail. Three were employed. One, stock diet No. 326, is adequate for normal development of dogs. Another, No. 515, contains the same ingredients as diet No. 326, but both liver and yeast are supplied in much greater

[1] From the Divisions of Biologics Control and Chemistry, National Institute of Health.

amounts. The third, No. 507, is deficient in nicotinic acid and riboflavin. However, during the period of the present study the dogs receiving the latter diet were given a low maintenance supplement of riboflavin. Furthermore, just before the termination of the present study, certain of the dogs were given large doses of riboflavin, but so far as we have been able to determine the intake of riboflavin had no influence on the amount of V factor excreted in the urine.

The other 2 dogs (348 and 389) were maintained on stock diet No. 326 for 301 and 275 days, respectively, before they were sacrificed.

The rats were maintained on stock diet No. 516 (*11*).

Collection of urine.—The procedure for collecting urine from dogs, previously reported by Fraser, Topping, and Sebrell (*1*), was, briefly, as follows: After voluntary urination the dog was given by stomach tube as much water as apparently it was able to retain comfortably. The amount given to different dogs varied from 360 to 700 ml. The dog was placed in a metabolism cage and during the next 4 hours the urine was collected in dark-colored bottles. Several times during the collection period the urine that had been excreted was placed in the icebox. The male dogs were catheterized for residual urine. The total amount of urine from each dog was measured and the specific gravity determined. A portion was filtered through a Berkefeld N filter for sterilization. The bacterial test for the determination of the V factor was set up as quickly as possible after collection.

Extraction of tissues.—Extractions were made from certain tissues of 6 dogs and 7 rats. Three of the dogs were suffering from blacktongue and 3 were normal. The rats were normal.

The dog tissue extracts were made at three different times, 1 dog with blacktongue and 1 normal dog being used each time. For the extraction of the tissues of the first 2 pairs of dogs the method of v. Euler and associates (*12*) was largely followed, while for the third pair certain procedures suggested by Dr. A. E. Axelrod (*13*) were followed. The procedures are as follows:

First pair of dogs: The animals were sacrificed one at a time; then, as quickly as possible, about 20 grams of each of the tissues to be studied were removed, weighed, ground in a mortar with sand, after which hot distilled water (90°–95° C.) was added to make a 10 percent suspension. The suspension was placed over a flame and, with continuous stirring, was heated at 95°–100° C. until the red color of the tissue had just turned brown. The time required was from 1 to 2 minutes. After standing for a short time the supernatant was decanted, water equal in weight to the original suspension was added, and the mixture was shaken for 1 hour. The supernatant was again decanted. The residue was washed with one-half the amount of water added for the second extraction. The two supernatants and the washing were combined and then filtered through paper and a Berkefeld N filter. The final extract represented a 1:25 dilution of the tissue.

Second pair of dogs: The procedure differed from that used with the first pair only in that the dogs were exsanguinated and the final washing of the tissue was omitted.

Third pair of dogs: These animals were also exsanguinated. From 1- to 2-gram portions of tissue were used. Immediately upon removal, the tissue was quickly frozen in a mortar sitting in a bath of solid carbon dioxide and methyl cellosolve[2] of approximately −78° C. Then it was weighed on a cold watch glass, returned to the mortar and ground, after which it was added to 29 cc. of hot water per gram of tissue. It was heated directly over a flame for approximately a minute, then cooled quickly in a cold water bath, and finally filtered through paper and a Berkefeld N filter.

[2] The methyl ether of ethylene glycol.

Rat tissue extraction: The procedure was essentially the same as for the third pair of dogs. The animals were killed by decapitation. The time elapsing between decapitation and the removal of the last tissue ranged from 1½ to 3 minutes.

The bacterial test for the determination of the V factor in the extracts was set up immediately after the extractions were completed.

Diphosphopyridine nucleotide (DPN).—The DPN was prepared by Dr. F. S. Daft, of this laboratory, according to the method of Meyerhof and Ohlmeyer (*14*). Its growth-promoting activity for *Hemophilus parainfluenzae* was slightly better than that of a preparation of triphosphopyridine nucleotide furnished to Dr. Sebrell through the courtesy of Professor O. Warburg, and the same as that of a sample of DPN prepared by Dr. J. M. Johnson, of this laboratory. The latter preparation was kindly assayed by Dr. Axelrod, who reported its activity to be the same as that of a sample of pure DPN supplied to him by Professor von Euler.

Culture.—One strain of *Hemophilus parainfluenzae*, No. 429, was used for all the bacterial work. It was isolated in 1932 from the spinal fluid of a child who had a brain abscess (*15*).

Culture medium.—The basal medium, containing no V factor, was prepared according to the formula used by Lwoff and Lwoff (*8*) except that the phosphate buffer was omitted. It consisted of Difco proteose peptone 20 gm., sodium chloride 6 gm., distilled water 1 liter, sodium hydroxide to bring it to pH 7.5, and glucose 0.5 gm. (1 ml. of a 50 percent solution) which was added after sterilization. If buffer was present in the medium a precipitate formed during incubation which interfered with the reading of the bacterial turbidity. So far as we could determine there was no difference in the amount of growth in the presence or absence of buffer. In this medium *Hemophilus parainfluenzae* multiplies only if growth factor V has been added.

Determination of V factor.—To determine the amount of V factor in urine or tissue extracts simultaneous titrations were carried out with solutions of DPN of known concentration which served as a standard. Then that dilution of the unknown which promoted bacterial growth of the same density as that promoted in the presence of a known amount of DPN was interpreted as having an amount of V equivalent to the DPN. So far as is known the test for V factor is specific for the coenzymes, DPN and TPN, but it does not distinguish between the two (*8, 10*). The procedure for the test was as follows:

1. Twofold dilutions of the unknown solutions were prepared in the culture medium in ⅝ x 6-inch test tubes. The final volume in each tube was 3 ml.; this amount provided a relatively large surface for aeration. A larger quantity was not used since it has been shown that a definite relation exists between the amount of V factor and the amount of air required for the growth of *Hemophilus influenzae* (*16*), although the influence of aeration on the amount of V factor required to promote growth of *Hemophilus parainfluenzae* is not known.

For urine the dilutions ranged from 1:5 to 1:80. For tissue extracts they ranged from around 1:100 or lower to a dilution beyond the limit of activity. With some tissues the final dilution was as high as 1:400,000.

The sterility of each solution was ascertained by incubating an uninoculated portion of the lowest dilution.

2. In a similar manner, the control dilutions of DPN were prepared in concentrations of 1 part in 50,000,000, 100,000,000, 200,000,000, and 400,000,000.

3. Each tube was inoculated with 0.1 ml. of a 24-hour-old culture which had been grown in medium to which just enough yeast extract had been added to promote a slightly turbid growth. A control tube of medium, without V factor, similarly inoculated, showed no growth in any instance.

4. The cultures were incubated from 40 to 42 hours. After the first 24 hours they were shaken to increase aeration. Preliminary tests with DPN showed that the maximum amount of growth was not obtained until after incubation for 24 hours. Furthermore, if the amount of growth at the end of 24 hours was plotted against the dilutions of DPN approaching the limit of activity a broken line was obtained, while if the amount of growth at the end of 40 or 42 hours was similarly plotted a straight line resulted. Lwoff and Lwoff (*8*) found that when approaching the active limit of dilution of V factor the amount of bacterial multiplication is closely related to the amount of the growth factor present.

5. After incubation, the density of 4 or more dilutions of each unknown which showed decreasing amounts of growth was measured photometrically. An absorption cell, 0.242 inches in depth, and an orange-colored filter, No. 61, were employed. The actual density due to growth was obtained by subtracting from the first reading the reading of the inoculated control medium which contained

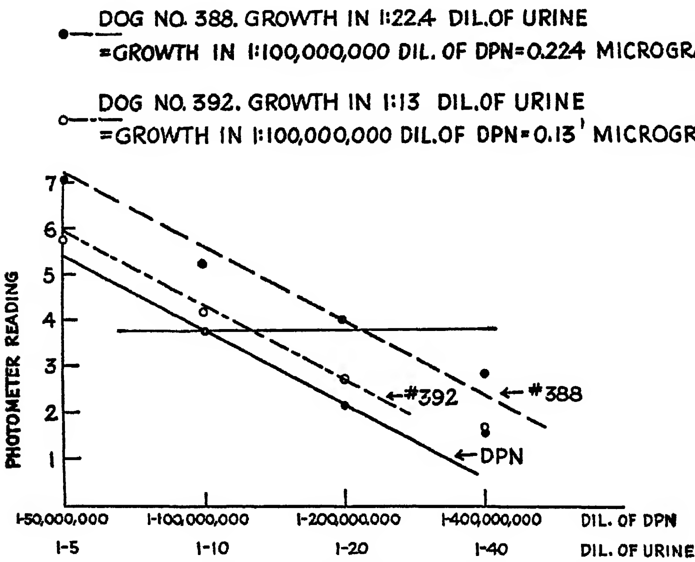

FIGURE 1.—Estimation of the amount of V factor in the urine of two dogs.

no V factor and also no growth. The density of the cultures in the 4 dilutions of DPN was similarly measured. Then the value of each was plotted against the dilution on semilogarithmic paper, and by interpolation an estimate of the V factor in the unknown was made. The point selected for interpolation was at the 1:100,000,000 dilution of DPN. Repeated tests showed that this point lay approximately in the center of that part of the curve which formed a straight line. The dilution of the unknown which promoted the same amount of growth as did this dilution of DPN was interpreted as having a corresponding amount of V factor, that is, one hundred millionth of a gram or one hundredth microgram per ml.

Figure 1 illustrates the procedure of determining the amount of V factor in 2 specimens of urine. The photometer reading of the growth in each dilution of urine and of DPN is plotted against the dilution. A horizontal bar drawn through the point at the 1:100,000,000 dilution of DPN crosses the other two curves at the 1:22.4 and the 1:13 dilutions of the urine from dogs 388 and 392, respectively. The latter points indicate the respective dilutions of urine which promoted the

same amount of growth as did the 1:100,000,000 dilution of DPN. In other words, the two specimens contained, respectively, an amount of V factor equivalent to 0.224 and 0.13 micrograms of DPN per ml.

GROWTH FACTOR V IN THE URINE OF DOGS

During a period of about 2 months, 1 to 7 determinations of the V factor in the urine of each of 11 dogs were made. In table 1 are given the diets of the respective dogs and the results of the determinations, which are expressed, first, in the dilutions of urine which promoted growth equivalent to that in the presence of a 1:100,000,000 dilution of DPN, second, in the average DPN equivalent per ml., and, third, in the average total DPN equivalent per kilogram weight of dog excreted during the 4-hour observation period.

Two of the dogs were being maintained on a blacktongue-inducing diet and developed blacktongue during the course of the experiment. Five were being maintained on the same diet supplemented with approximately 2 to 10 times the amount of nicotinic acid, which has been shown by Sebrell, Onstott, Fraser, and Daft (*17*) to be required to prevent the development of blacktongue. The remaining 4 were being kept on a diet rich in liver and yeast.

The dilutions of urine promoting growth equivalent to the designated amount of DPN varied from a low of 1:4 to a high of 1:22.4. The average dilution for an individual dog varied from 1:10 to 1:20.4. For the majority of the dogs, however, the average dilutions were very similar: 5 were from 1:14.3 to 1:14.7, and 3 others were not far from these figures, 1:13.5, 1:15.2, and 1:17.5. The remaining 3, however, showed considerable variation, 1:10, 1:11, and 1:20.4. The latter figure was obtained from only 2 determinations of urine from dog 388 after blacktongue had developed. No determination was made preceding onset of symptoms. Furthermore, on the occasion when the highest figure, 1:22.4, was obtained the forced amount of fluid was less than the usual amount. With the other dog, 358, which developed blacktongue there was no significant difference in the amount of excreted V factor before or after the onset of blacktongue symptoms. Moreover, the amount excreted by this dog on a nicotinic acid deficient diet was no different from that excreted either by 2 dogs (391 and 407) whose diets were supplemented with nicotinic acid or by 2 other dogs (431 and 432) maintained on a diet rich in liver and yeast.

Although only 2 dogs maintained on a nicotinic acid deficient diet were studied, the relative high or comparable amount of V factor excreted suggests that there is not a decrease in the amount excreted by dogs suffering from blacktongue.

Likewise, dogs that were fed different amounts of nicotinic acid showed no correlation in the amount of V factor excreted. Three

TABLE 1.—*The excretion of growth factor V in the urine of dogs*

Number of dog	Diet	Date of urine collection (1939)	Clinical condition	Dilution promoting growth equivalent to that of 1:100,000,000 dilution of DPN	Average	DPN equivalent of average dilution (microgram/ml.)	Average 4-hour excretion of urine: Total amount collected (ml.)	Amount per kg. weight of dog (ml.)	DPN equivalent per kg. weight of dog (microgram)
388, female, 7.5 kg.	Blacktongue inducing No. 507.	Apr. 10	Early blacktongue.	[1] 1:22.4	1:20.4	0.204	350	46.67	9.52
		Apr. 13	do	1:18.4					
358,[2] male, 11.0 kg.		Apr. 26	Normal	1:15.6	1:14.7	0.147	553	50.27	7.39
		May 2	do	1:13.3					
		May 9	do	1:15.7					
		May 16	do	1:13.7					
		June 1	Early blacktongue.	1:14.1					
		June 6	Blacktongue	1:15.9					
391, male, 13.8 kg.	Plus 0.2 mg. nicotinic acid/kg. daily.	Apr. 12	Normal	1:16.6	1:14.6	0.146	538	38.90	5.69
		Apr. 24	do	1:15.9					
		May 2	do	1:12.5					
		May 9	do	1:12.0					
		May 17	do	1:15.9					
396, male, 5.75 kg.	Plus 0.23 mg. nicotinic acid/kg. daily.	Apr. 12	do	1: 8.1	1:10.0	0.10	343	59.65	5.97
		Apr. 24	do	1:10.0					
		May 2	do	1: 9.1					
		May 9	do	1:14.8					
		May 16	do	1: 8.0					
407,[3] male, 11.1 kg.	Plus 0.2 mg. nicotinic acid/kg. daily.	Apr. 13	do	1:15.2	1:14.7	0.147	508	45.76	6.73
		Apr. 25	do	1:17.2					
		May 10	do	1:12.8					
		May 16	do	1:13.7					
		June 1	do	1:16.0					
		June 6	do	1:13.2					
392, male, 7.6 kg.	Plus 1.06 mg. nicotinic acid/kg.	Apr. 10	do	1:13.0	1:15.2	0.152	485	63.82	9.70
		May 3	do	1:15.7					
		May 17	do	1:17.6					
		June 1	do	1:16.0					
		June 6	do	1:13.6					
401, male, 8.75 kg.	Plus 1.2 mg. nicotinic acid/kg.	Apr. 17	do	1:13.6	1:11.0	0.110	595	68.0	7.48
		Apr. 25	do	1: 4.0					
		May 2	do	1: 9.6					
		May 10	do	1: 9.8					
		May 16	do	1: 9.8					
		June 1	do	1:15.0					
		June 6	do	1:15.2					
430, female, 5.5 kg.	High liver and high yeast No. 515.	Apr. 12	do	1:13.5	1:13.5	0.135	400	72.73	9.83
431, male, 12.1 kg.		Apr. 12	do	1:12.9	1:14.3	0.143	555	45.87	6.56
		Apr. 26	do	1:15.6					
432, male, 12.0 kg.		Apr. 13	do	1:14.8	1:14.4	0.144	745	62.08	8.94
		Apr. 24	do	1:15.9					
		May 3	do	1:11.6					
		May 10	do	1:14.8					
433, male, 6 kg.		Apr. 13	do	1:14.0	1:17.5	0.175	312	52.4	9.17
		Apr. 26	do	1:21.4					
		May 3	do	1:20.0					
		May 10	do	1:17.2					
		May 17	do	1:14.8					

The values presented in this table are suitable for comparing the amount of V factor in the urine of dogs on various regimes respecting nicotinic acid. They should not be interpreted as absolute quantities of V factor in the urine of dogs.

DPN=Diphosphopyridine nucleotide.

[1] 360 ml. of water were given instead of the usual amount of 480 ml.; 250 ml. of urine were collected, while the average amount preceding onset of blacktongue was 454 ml.

[2] Dog 358 was given 66 mg. of nicotinic acid on Apr. 10 for treatment of an attack of blacktongue.

[3] During each of the 4-hour periods for urinary collection there was complete retention. The specimens were collected by catheterization at the end of the 4-hour period.

dogs (391, 396, and 407) which received daily 0.2 and 0.23 mg. per kilogram showed a variation in excretion from 0.10 to 0.147 microgram DPN equivalent per ml., while 2 dogs (392 and 401) which received daily 1.06 and 1.2 mg. per kilogram showed a similar variation from 0.11 to 0.152 microgram. In addition, 4 dogs that were fed large amounts of liver and yeast showed no greater excretion than the other dogs. The amounts ranged from 0.135 to 0.175 microgram per ml.

It should be mentioned that the values presented are not to be interpreted as the absolute quantities of V factor in the urine of dogs. However, they do serve as a basis of comparison of the relative values obtained from dogs on various regimes respecting nicotinic acid.

The above observations indicate, under the conditions of our experiments, that there are some individual variations in the amount of V factor excreted in the urine of dogs, that the majority of dogs excrete a fairly equal amount and that the amount excreted is apparently not influenced by the amount or the lack of intake of nicotinic acid. In fact, when the probability of errors of technique and the limitations of the method employed are considered it is surprising to find that for 8 of 11 dogs, the greatest individual variation of the mean of 0.149 is only 0.026. Furthermore, when the values for all 11 dogs are calculated on the basis of the total DPN equivalent excreted per kg. of body weight during the 4-hour observation period, the range of variation is only from 5.69 to 9.83 micrograms with a mean of 8.0.

In contrast to our observations made with dogs, is the indication that the amount of V factor excreted in the urine of man may be influenced by the administration of nicotinic acid. Spies and Koch (unpublished work cited by Vilter, Vilter, and Spies (*18*)) report that the urine of 20 normal persons supported growth of *Hemophilus influenzae* in dilutions of 1:100 and often dilutions of 1:1,000. The urine from a patient with chronic lymphatic leukemia promoted growth in dilution of only 1:10 and after administration of nicotinic acid, 500 mg. daily, there was a transient increase in the V factor excreted in the urine. The amount of increase is not given.

GROWTH FACTOR V IN TISSUES OF NORMAL DOGS AND OF THOSE WITH BLACKTONGUE

The V factor in tissue of only 6 dogs, 3 normal and 3 suffering from blacktongue, were studied. The number examined is too small to form a basis for conclusions; however, the relative, but not absolute, values are largely in agreement with the findings of other workers.

In table 2 are presented the amounts of V factor which were found in different tissues. The tissues from the first 2 pairs of dogs were extracted by the v. Euler method and those from the third pair

were kept frozen until added to hot water. The details were given above. The slightly higher values obtained for the normal dog of the latter pair as compared with the corresponding values for the other normal animals indicate that in the frozen state the inactivation of V by enzymes is retarded.

TABLE 2.—*Growth factor V in tissues of blacktongue and normal dogs*

Tissue	V factor equivalent of DPN—microgram per gram of fresh tissue[1]					
	Blacktongue 429 (male)	Control 848 (female)	Blacktongue 388 (female)	Control 889 (female)	Blacktongue 358[2] (male)	Control 401[2] (male)
Kidney	225	225	230	92.4	208	322
Liver	67	101	68	88	81	139
Heart	----------	----------	82	104	32	178
Thigh muscle	15	101	34	42	30	178
Large intestine	----------	----------	[3]2.8	20	73	78
Blood	----------	----------	48	44	32	28
Brain	----------	----------	33	33.6	16	32
Uterus	----------	----------	13	19	----------	----------

[1] The values are not to be interpreted as absolute quantities of V factor in tissues of the dog.
[2] Tissues of dogs 358 and 401 were frozen immediately on removal. The amount of food given to control dog 401 was restricted to the amount consumed by blacktongue dog 358 (paired feeding principle).
[3] Mucosa showed extensive necrosis.

In each instance the values for liver, heart, and thigh muscle from the blacktongue dog were lower than those from the normal controls. For the liver they were 20 to 40 percent lower, for cardiac muscle 70 to 80 percent, and for thigh muscle 15 to 85 percent. In one instance the value was lower for the large intestine, kidney, and brain. In this particular case the large intestine showed extensive necrosis and its value was 80 percent lower than for the normal dog. The values for blood, although slightly higher for the dogs with blacktongue, were the same when corrected by the hematocrit reading.

After the completion of our work there appeared reports on the V factor content of tissues from a larger number of normal and blacktongue dogs by Kohn, Klein, and Dann (*19*) and on the coenzyme I (DPN) content of tissues from 1 normal and 2 blacktongue dogs by Axelrod, Madden, and Elvehjem (*20*). The latter used the yeast fermentation method of v. Euler and Myrbäck. Each found for the blacktongue dog a lower value for liver and muscle but not for kidney or blood. In addition, Kohn, Klein, and Dann reported no decrease in heart or brain. The actual values which we obtained for normal dogs were, as a whole, roughly about 50 percent lower than Kohn's, and about 65 percent lower than Axelrod's.

The failure of nicotinic acid to change the level of V factor in the blood of dogs is in contrast to the direct effect of nicotinic acid on the level in man, reported by Kohn (*10*) and Vilter, Vilter, and Spies (*21*). Kohn and Bernheim (*22*), however, from the results of a study of the V factor level in the blood of a large number of normal and pathological

subjects, came to the conclusion that there are factors other than diet or disease that regulate the blood level in man as well as in the dog.

GROWTH FACTOR V IN TISSUES OF NORMAL RATS

V factor determinations were made on the liver, kidney, and thigh muscle of 7 rats. The results are given in table 3. The values obtained for individual rats are in fairly close agreement. The average amounts per gram of liver, kidney, and muscle were 345, 456, and 353 micrograms, respectively. These values are higher than the combined DPN and TPN values reported by v. Euler and associates (*12*), who report 245, 200, and 240 micrograms for the respective tissues. They state, however, that the quantitative measurements of cozymase (DPN) were around 20 to 40 percent below the real values. They used the fermentation method of Myrback.

TABLE 3.—*Growth factor V in tissues of normal rats*

Rat (male) No.	Weight (gm.)	V factor equivalent of DPN—microgram per gram of fresh tissue [1]		
		Liver	Kidney	Thigh muscle
1	420	445	460	435
3	312	330	482	430
4	367	330	430	353
5	56	[2] 210	434	300
6	56	325	565	390
7	408	325	[3] 264	258
8	303	325	365	303
Average		345	456	353

[1] The values are not to be interpreted as absolute quantities of V factor in tissues of the rat.
[2] Tissue thawed while weighing, omitted in making the average
[3] Some was lost while grinding, omitted in making the average

On the other hand, our values are lower than the V factor determinations of Bernheim and Felsovanyi (*23*) and the coenzyme I (DPN) values of Axelrod and Elvehjem (*24*) which were obtained by the fermentation method. For liver, kidney, and muscle the former report 542, 510, and 522 micrograms, and the latter 1,114, 1,077, and 782 micrograms, respectively.

DISCUSSION AND SUMMARY

In the work presented in this communication, the amount of V factor excreted in the urine of 11 dogs has been determined by the growth-promoting action of the urine for *Hemophilus parainfluenzae*. It was expressed in DPN equivalent per ml. The results, under the conditions of our experiment, suggest that the excretion of V factor in the urine of dogs is not influenced by a diet either deficient or rich in nicotinic acid. Two of the dogs developed blacktongue during the course of the experiment. The average amount excreted per ml. by 8 of the dogs was in fairly close agreement. The other 3 showed con-

siderable variation but the variation could not be correlated with intake of nicotinic acid.

The amount of V factor in certain tissues of the dogs, however, did show some correlation with the intake of nicotinic acid. The liver, muscle, and heart of dogs suffering from blacktongue contained less V factor than did the corresponding tissues of normal dogs. The blood levels were not affected. Kohn, Klein, and Dann (*19*) have reported smaller amounts of V factor in the liver and muscle of blacktongue dogs, and likewise Axelrod, Madden, and Elvehjem (*20*) have reported smaller amounts of DPN in the same tissues. Both groups report no change in the blood level. Their values, however, are somewhat higher than ours.

The technique which we employed for the determination of V factor was, in many respects, similar to that of Kohn, Klein, and Dann (*19*). However, a different strain of *Hemophilus parainfluenzae* was used and whereas it was necessary to incubate our cultures for about 40 hours they were able to make readings in 20–24 hours. There were also certain differences in the basal medium.

In addition, the amount of V factor in the liver, kidney, and muscle of 7 rats was determined in a similar manner. The values which were obtained were higher than those obtained by some but lower than those obtained by other workers.

The lack of agreement of the amount of V factor or DPN in the tissues of dogs and rats, determined by different workers, serves to emphasize the difficulties that are encountered in determining the amount of a coenzyme which is so readily inactivated by both heat and certain enzymes that are present in the tissues.

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TWO NEW SPECIES OF ARGASIDAE (ACARINA: IXODOIDEA)[1]

By R. A. Cooley, *Entomologist*, and Glen M. Kohls, *Assistant Entomologist, United States Public Health Service*

A description is given in this paper of two new species of argasid ticks: *Ornithodoros dyeri*, collected on bat guano in Arizona, and *Otobius lagophilus*, a widespread western species that infests rabbits.

Ornithodoros dyeri n. sp.

On September 24, 1939, Dr. C. B. Philip and Max T. McKee of the Rocky Mountain Laboratory collected several hundred specimens of *Ornithodoros coprophilus* from a mine tunnel on Picacho Mountain, Pinal County, Ariz. This was the first time this tick had been observed in nature, and the significant data pertaining thereto have been reported by Philip (1939). More recently in additional

[1] From the Rocky Mountain Laboratory, Hamilton, Mont., Division of Infectious Diseases, National Institute of Health.

tick-infested guano forwarded from this same mine by Mr. L. O. Brown, 3 adults and 25 nymphs of the new species, *dyeri*, were found. The specimens showed no evidence of having fed recently and all were moderately thin. The adults all appear to be of the same sex; we are as yet uncertain as to whether they are male or female.

ADULT

Body.—Elongated, sides parallel, anterior end pointed, posterior end rounded. Length 3.57 mm.; width 1.5 mm. Margins flattened and with the structure of the integument differing from that of the dorsal and ventral surfaces. Viewed in lateral profile the dorsal body line is nearly straight. The entire dorsum is bounded by two continuous ridges, essentially parallel; there is a third (inner) ridge on each side. Within these ridges the dorsum is irregular owing to ridges and subcircular elevations, the latter being the discs.[2] Mammillae are absent. Hairs are very fine and short, more abundant posteriorly and absent outside the marginal ridges. Specimens recently put in 70 percent alcohol are light yellow-brown in color.

Legs.—Moderate in length, small, micromammillated, and with fine short hairs; on all tarsi are two parallel, ventral rows of equally spaced hairs. Length of tarsus I, 0.42 mm.; metatarsus I, 0.36 mm. Length of tarsus IV, 0.51 mm.; metatarus IV, 0.39 mm. All tarsi without humps and subapical protuberances. Stalk of the pulvillus and claws progressively longer on legs I to IV. Femur of leg IV longer than that of I, II, or III. Length of femur (including trochanter) of leg IV, 0.66 mm.; length of femur (including trochanter) of leg I, 0.54 mm.

Coxae.—Coxae II, III, and IV contiguous; coxae I and II separated. Surface of all coxae micromammillated. Hairs absent on the coxae except for a single row near the articulation with the trochanter on coxae II, III, and IV.

Movable cheeks.—Present, longer than wide, and together with a ventral projection of the tip of the dorsal body wall forming some protection for the mouth parts but never as much as in some species (e. g., *talaje*).

Capitulum.—Basis large, about as broad as long; surface irregular, having both micromammillae and irregular transverse ridges. The hairs on palpi and the posthypostomal hairs are barbed. Two groups of short heavy spines present on posterior ventral surface, one on each side of the median line.

Palpi.—Moderate in length, tapering, and with barbed hairs.

[2] In the Argasidae the "discs" and similar structures arranged in a symmetrical pattern are the external evidence of modifications of the structure of the body wall at the points of attachment of the dorsoventral muscles. They vary structurally in the numerous species Some previous authors have indicated that "obvious" discs may be present or absent We prefer to accept the term "disc" as appropriate in defining *any* structural modifications of the body wall at the points of attachment of the dorsoventral muscles.

Hypostome.—Short, broad, with sides nearly parallel, truncate; posthypostomal hairs long, barbed, reaching the tip of the hypostome. There is also a pair of shorter postpalpal hairs at the bases of the palpi. Denticles short, U-shaped, arranged 5/5, covering about the anterior two-thirds of the hypostome, without great difference in the sizes of the denticles; the median files are faint. Length, 0.165 mm. (measured from the large posthypostomal hairs to the anterior termination).

Folds.—The folds on the venter form an intricate pattern the main features of which are the following: Supracoxal and coxal folds continued posteriorly and meet to continue as a submarginal fold that forms a loop paralleling the posterior margin. Connected with the loop posteriorly are two folds that converge anteriorly and reach nearly to the coxal folds. From these arise two medially directed spur folds just anterior to the transverse postanal groove, which terminate at the median postanal groove. In addition to the remarkable folds in this species there is a fold or ridge above the supracoxal fold opposite legs III and IV, which is bent downward posteriorly and becomes an arc of a circle, the radial center of which would be the insertion of leg IV. The top of this arc is smooth while the surface of all other ridges is irregular. In living specimens leg IV in its movements is in contact with the smooth ridge, which is enough elevated to protect the spiracle placed just below it. Leg IV comes in contact with this smooth arc at about the trochanter.

Grooves.—Only one definite groove is present, a deep, short, transverse postanal groove.

Sexual opening.—Opening placed in a V-shaped depression at about the level of the posterior ends of coxae I.

Eyes.—Absent.

Anus.—Small, in an oval pattern.

NYMPH

The characters of the nymphs are much the same as of the adults but in the last nymphal stage there is a depression at the position of the sexual opening that approaches the definite V-shaped depression of adults. The smallest nymphs are shorter in proportion to the width. Nymphs range in size from 1.98 mm. x 1.11 mm. to 3.48 mm. x 1.44 mm.

Holotype.—A. P. 16083, from bat guano, November 3, 1939, Picacho Mountain, near Picacho, Pinal County, Ariz.

Paratypes.—Two adults and two nymphs: One (adult) deposited in the United States National Museum and one (nymph) in the collections of the Zoological Division of the Bureau of Animal Industry, United States Department of Agriculture.

The holotype and two paratypes are in the collection of the Rocky Mountain Laboratory.

This remarkable small tick from bat guano is readily separated from other species of the genus by its elongated body, the parallel marginal ridges, the pattern of ridges on the venter, and numerous other characters. We take pleasure in naming it *Ornithodoros dyeri* in honor of Dr. R. E. Dyer, Chief of the Division of Infectious Diseases of the National Institute of Health.

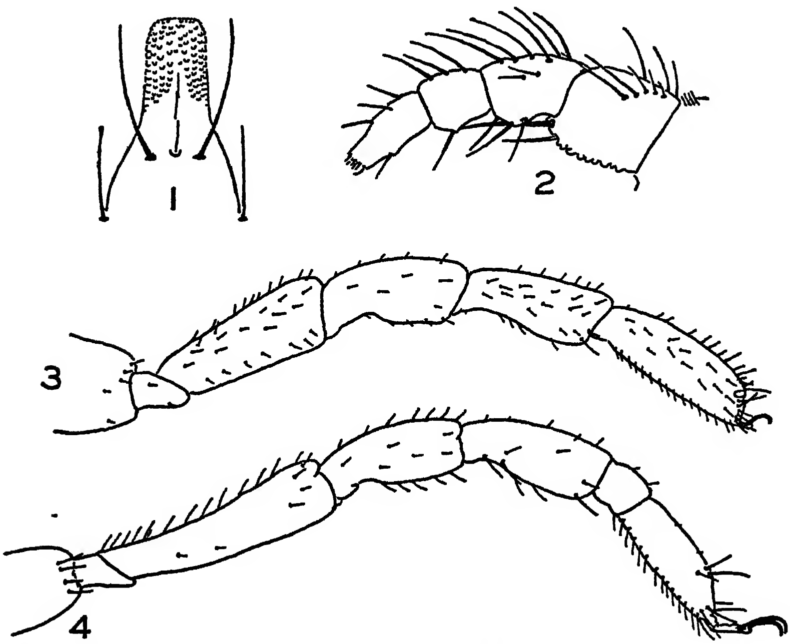

FIGURE 2.—Adult, *Ornithodoros dyeri* n. sp. 1. Hypostome (paratype). 2. Palpus in lateral view from the median side. 3. Leg I. 4. Leg IV.

Otobius lagophilus n. sp.

For some time there has been doubt about the specific identity of the *Otobius* which is fairly common on rabbits in the northwestern part of the United States. Dr. S. Hadwin (1913) recorded a tick from jack rabbits from Lethbridge, Alberta, Canada, which had been identified as *Ornithodoros megnini*. Dr. Arthur Gibson, Dominion Entomologist, has recently sent us the single specimen referred to above, collected in October 1912, as well as three others from a jack rabbit, without date of collection. Cooley (1932) states that "*megnini*" had been collected from rabbits by Dr. R. R. Parker at Powderville, Mont., in 1916 and by Morton from rabbits near Bozeman and near Musselshell in 1930. All four Canadian specimens and the Montana specimens are identical with the new species here described.

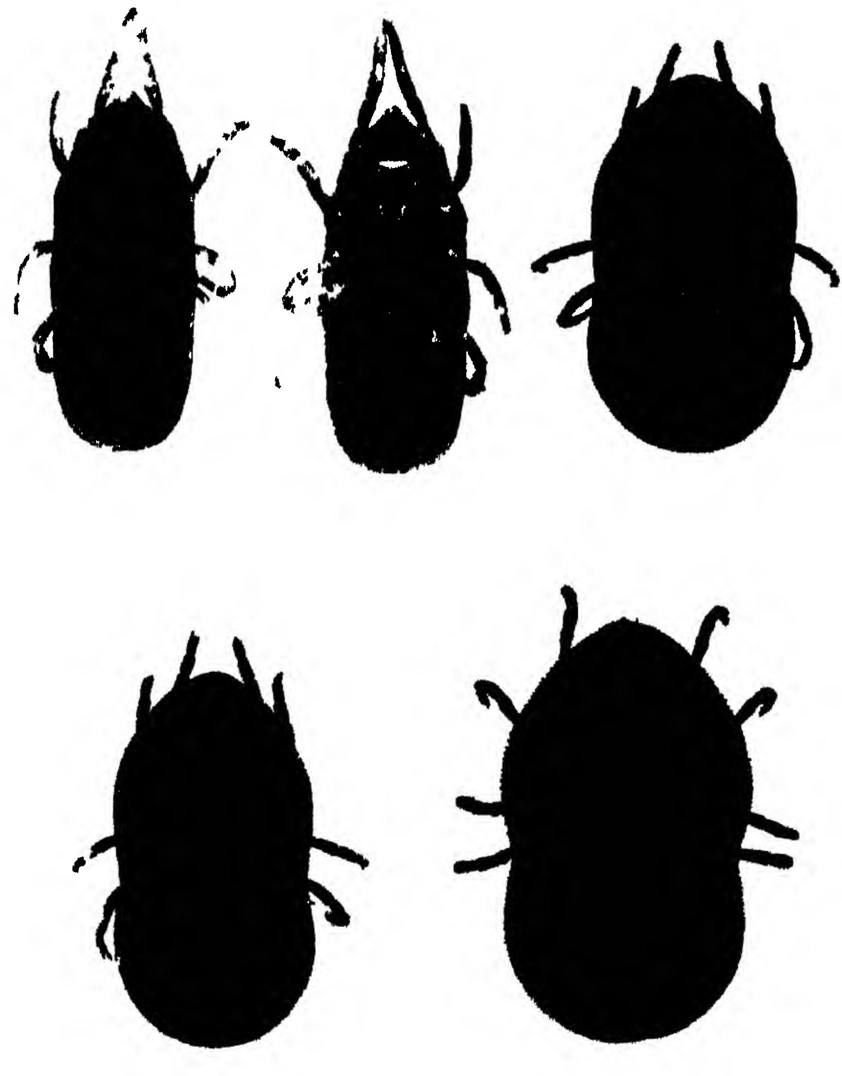

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FIGURE 1.—1 *Ornithodoros dyeri* n sp, dorsal view 2 *Ornithodoros dyeri* n sp, ventral view 3 *Otobius lagophilus* n sp male, dorsal view 4 *Otobius lagophilus* n sp male, ventral view 5 *Otobius lagophilus* n sp nymph, dorsal view

ADULT

Body.—Broadly rounded posteriorly, somewhat narrowed anteriorly, and a little constricted at the side just behind legs IV (less constricted and not as definitely panduriform as in *megnini*); widest at legs II and III. Size of female: Length 5.40 mm. to 6.25 mm.; width 3.60 mm. to 4.00 mm. Size of male: Length 4.75 mm. to 5.00 mm.; width 2.90 mm. to 3.50 mm.

Specimens of adults and nymphs preserved in alcohol are enclosed by a brittle, thin, translucent covering which is easily removed with a needle. The true character of the integument is better seen after this covering is removed.

Mammillae.—True mammillae, as defined in *Ornithodoros* by various authors, are absent. Integument on dorsal and ventral surfaces granulated, with numerous intermingled circular depressions which are larger and less definite than in *megnini*; floor of each depression with a faint central tubercle.

Hairs.—Short, fine hairs present on the dorsal surface. These hairs are situated on the tubercles in the circular depressions and are a little more apparent toward the anterior end of the tick. On the ventral surface such hairs are less apparent except near the mouth parts.

Discs.—Indefinite yet evident as a symmetrical pattern of small depressions the floors of which are irregular. The discs are less apparent than in *megnini*.

Legs.—Short and moderately heavy, with hairs few and small. All tarsi with moderate subapical dorsal projections. On tarsus IV this projection is more pronounced. Length of tarsus I, 0.45 mm.; metatarsus I, 0.39 mm. Length of tarsus IV, 0.54 mm.; metatarsus IV, 0.525 mm.

Coxae.—Coxae III and IV contiguous, the others separated. There are deep invaginations between the coxae which are shown by dissection to be the surface indications of large apodemes. Each coxa with an elongated smooth sclerite.

Hood and camerostome.—Definite hood and camerostome are not apparent though there is a moderate swelling, ventrally excavated, just anterior to the mouth parts.

Capitulum.—Basis very broad and short, curved, approaching a reniform shape with the convex border behind. Surface irregular, with fine hairs at the sides near the palpi and two groups at each side of the median line near the posterior margin.

Palpi.—Moderately heavy, with article 1 a little more swollen than the others. Hairs fine and long.

Hypostome.—Vestigial, in marked contrast with the well-developed hypostome of the nymph. Broad, short, tapering, without denticles, concave dorsally and convex ventrally, bluntly rounded or bilobed apically; length about 0.10 mm.

Folds.—Coxal and supracoxal folds present though less in evidence in well engorged specimens.

Grooves.—A short transverse postanal groove present near the

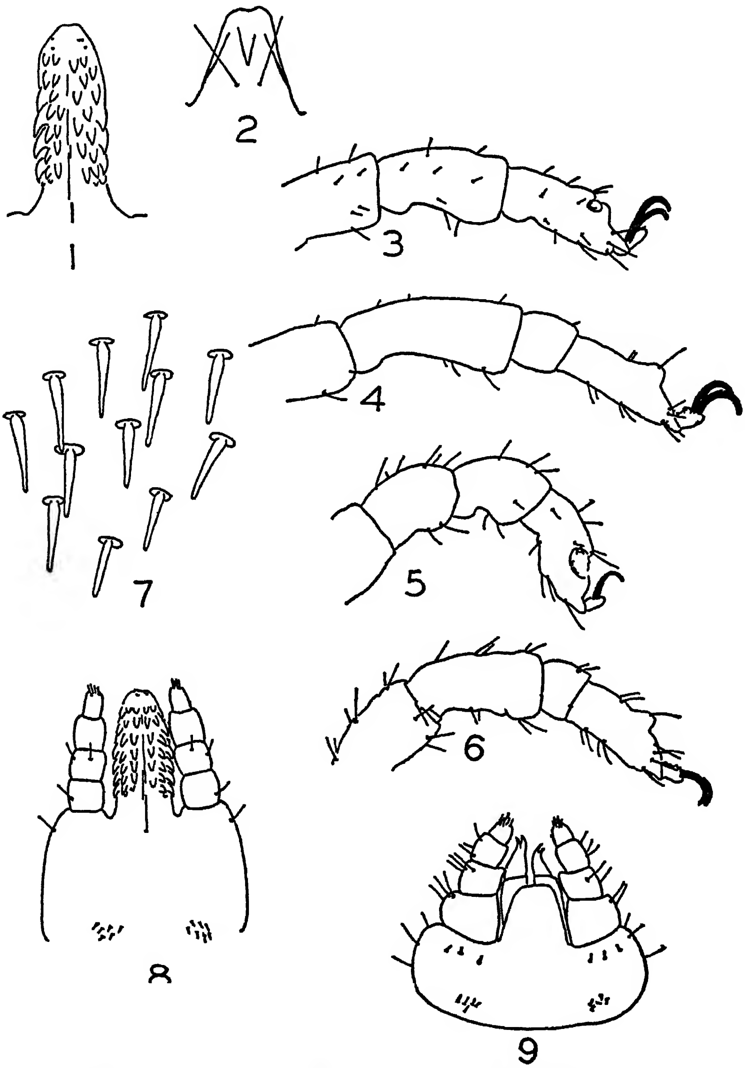

FIGURE 3—*Otobius lagophilus* n sp. 1. Hypostome of the nymph. 2. Hypostome of the female 3 Adult, tarsus and metatarsus of Leg I 4 Adult, tarsus and metatarsus of Leg IV. 5 Nymph, tarsus and metatarsus of Leg I 6. Nymph, tarsus and metatarsus of Leg IV. 7. Nymph, spines from the anterior margin 8 Capitulum of nymph, ventral 9 Capitulum of adult, ventral.

posterior end. Median postanal groove faint. All other grooves are absent or negligible.

Sexual opening.—In line with the posterior ends of coxae I.

Spiracle.—Ovate, with surface convex.

Eyes.—Absent.

Anus.—Small, nearly circular.

NYMPH

Shape and size about as in the adult.

Mammillae.—The integumental markings of the nymph are very different from those of the adult. Entire surface, dorsal and ventral, smooth and shining, with fine reticulations and transverse striae, similar to the body wall of larval Argasidae. Striae more apparent than in *megnini.*

Spines.—Spines or hairs are present over the entire surface of the body except in the area immediately surrounding the mouth parts; more abundant and longer at the anterior end; progressively smaller toward the posterior end; more sparse on the ventral surface.

Discs.—Definite discs are absent, but corresponding depressions are sometimes evident. These depressions are free of spines, and in some a few fine punctations are visible.

Legs.—Short and moderately heavy. Subapical projections absent or small on tarsi I, II, and III, but distinct on IV. Length of tarsus I, 0.36 mm.; metatarsus I, 0.30 mm. Length of tarsus IV, 0.45 mm.; metatarsus IV, 0.45 mm.

Coxae.—Present as inconspicuous sclerites.

Hood and camerostome.—Absent.

Capitulum.—In ventral view the capitulum is in a depression formed by a circular tumescence around it which makes it difficult to get a true impression of the shape of the basis capituli unless it is dissected out. Broader than long. Palpi moderately heavy (more slender than in *megnini*), and with article 1 lacking a distinct ventral swelling. Hairs small and few in number.

Hypostome.—Large, with sides nearly parallel, denticles long and sharp, in a 3/3 arrangement with the denticles about equally long in the basal and apical regions; denticles in the corona absent or few in number. Marginal denticles absent in the subapical region. Length, 0.30 mm.

Folds.—Coxal and supracoxal folds are faint or absent.

Grooves.—True grooves are absent but the preanal and median postanal grooves are indicated by shallow elongated depressions.

Spiracle.—Circular, mildly convex. (In *megnini* it is a conical protuberance.)

Holotype.—One of four nymphs (A. P. 13263) from a jack rabbit, *Lepus townsendii*, Dillon, Mont., July 2, 1937; deposited in the collection of the Rocky Mountain Laboratory.

Paratypes.—The three remaining topotypic specimens from A. P. 13263; 30 nymphs (A. P. 11154), jack rabbit, *Lepus* sp., Dillon, Mont.,

July 13, 1935, Wm. L. Jellison; 15 nymphs (A. P. 11235), 4 jack rabbits, *Lepus townsendii*, Beaverhead County, Mont., August 6, 1935, Wm. L. Jellison; 1 male (A. P. 8474A), cottontail rabbit, *Sylvilagus* sp., August 18, 1932, Mayfield, Idaho, Carl Larson; 2 females (A. P. 8401A), jack rabbit, *Lepus californicus*, August 12, 1932, Mayfield, Idaho, Carl Larson; 16 nymphs (A. P. 8104A), 2 jack rabbits, *Lepus* sp., June 30, 1932, Mayfield, Idaho, Carl Larson; 1 nymph (A. P. 16125), jack rabbit, *Lepus* sp., October 1912, Lethbridge, Alberta, Canada; 3 nymphs (A. P. 16124), jack rabbit, *Lepus* sp., (no date), Lethbridge, Alberta, Canada.

In addition to the type materials, the collection of the Rocky Mountain Laboratory contains also the following specimens: 1 nymph (A. P. 8062), jack rabbit, *Lepus* sp., White Pine County, Nevada, April 17, 1932, Wm. L. Jellison; 5 nymphs (A. P. 8124A), jack rabbit, *Lepus* sp., Grandview, Idaho, July 3, 1932, Carl Larson; 1 nymph (A. P. 8183A), jack rabbit, *Lepus* sp., Mayfield, Idaho, July 11, 1932, Carl Larson; 4 nymphs (A. P. 8431A), jack rabbit, *Lepus californicus*, Grandview, Idaho, August 15, 1932, Carl Larson; 1 nymph (A. P. 8483A), jack rabbit, *Lepus californicus*, Mayfield, Idaho, August 21, 1932, Carl Larson; 9 nymphs (A. P. 8613A), jack rabbit, *Lepus* sp., Grandview, Idaho, September 10, 1932, Carl Larson; 1 nymph (A. P. 9042B), jack rabbit, *Lepus* sp., Mayfield, Idaho, April 25, 1933, Carl Larson; 10 nymphs (A. P. 10159), "rabbit", Deer Lodge, Mont., October 2, 1934; 3 nymphs (A. P. 11108), jack rabbit, *Lepus townsendii*, Miles City, Mont., June 6, 1935, Glen M. Kohls and Wm. L. Jellison; 2 nymphs (A. P. 11278), "rabbit," Lander, Wyo., August 2, 1935, Dr. Gordon E. Davis; 1 nymph (A. P. 14086), host unknown, Laramie, Wyo., May 20, 1938, Dr. Gordon E. Davis; 2 nymphs, jack rabbit, *Lepus townsendii*, Bozeman, Mont., June 3, 1930, F. A. Morton; 2 nymphs (A. P. 12377A), jack rabbit, *Lepus* sp., Canyon County, Idaho, June 6, 1936, C. R. Eskey; 1 nymph (A. P. 16750), cottontail rabbit, *Sylvilagus* sp., Rupert, Idaho, June 16, 1939, Wm. L. Jellison; 1 nymph (A. P. 16218), jack rabbit, *Lepus townsendii*, Cameron, Mont., January 5, 1940, Wm. L. Jellison and Glen M. Kohls; 17 nymphs (A. P. 16895) *Lepus californicus deserticola*, Barstow, San Bernardino Co., Calif., June 20, 1924, University of Michigan Museum of Zoology.

This, the second known species of *Otobius*, is easily separated from *megnini* by the following characters: Its smaller size; the heavy V-shaped spines found on the anterior surfaces in *megnini* are replaced by slender spines the same as those on posterior parts; the denticles on the hypostome are in a 3/3 pattern instead of 4/4; the legs are more slender; the spiracle of the nymph is mildly convex instead of conically protuberant. This tick, in our experience, is always found in the fur on the face above the vibrissae. All specimens collected have been

nymphs. We believe that, in common with *megnini*, the adults of *lagophilus* are not parasitic.

During recent extended studies of the Argasidae of North America we have become more familiar with the different species found on the continent, and particularly with the characters which separate them. It has been found that there is much less confusing variation in many Argasidae than occurs in the Ixodidae, and, in some cases at least, there is corroborating evidence in the biologies of related species.

In the light of these studies it becomes clear that the *Otobius* on rabbits is very distinct from *megnini* on both morphological and biological grounds.

O. megnini appears to have been introduced into the northern States numerous times on cattle and in some areas has persisted for some years in spite of the more severe northern climate. For example, it was known to be present in Big Horn County, Mont. (Cooley, 1916) not far from the locality where Parker collected ticks from rabbits in 1916 and this fact appeared to support the assumption that the ticks from rabbits might be *megnini*.

This laboratory has twenty records covering numerous specimens of *O. megnini* taken from its usual hosts in southern California, Arizona, and New Mexico, and in much of the area covered we have numerous records of various ticks from rabbits. However, the California record is the only one we have of the new species from this region. In some instances we particularly searched for this tick on rabbits in the immediate areas where we collected *O. megnini* from domestic animals. Conversely, in Powell County, Mont., where *lagophilus* appears to be rather common, we have no records of *megnini* and correspondence with veterinarians has shown that they have not known of its presence in that area.

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VITAL STATISTICS SUMMARY FOR THE UNITED STATES, 1938

The Bureau of the Census, Department of Commerce, has recently issued a summary of vital statistics for the United States for 1938,[1] from which the following statements and tables are taken.[2]

[1] Vital Statistics, Special Reports, vol. 8, No. 51, pp. 1223–1248.

[2] Preliminary mortality data for 1938, by cause, were published in the Public Health Reports for February 2, 1940, pp. 211–214.

In 1938 there were 2,286,962 births and 1,381,391 deaths in the United States, giving a birth rate of 17.6 and a death rate of 10.6 per 1,000 population. Of the total deaths, 116,702 were of infants under 1 year of age, giving an infant mortality rate of 51.0 per 1,000 live births. As previously noted, both the crude general death rate and the infant mortality rate for 1938 were the lowest ever recorded for the United States, as was also the maternal mortality rate.

Table 1 summarizes the natality, general mortality, and infant mortality data for the registration areas of the United States for the 11-year period 1928–38, inclusive, and the accompanying chart shows

TABLE 1.—*Abstract of vital statistics data for the registration areas*

Year	Percent of total population in registration areas		Number		Crude rate (number per 1,000 estimated population)		Births per 100 deaths	Death rate (number per 1,000 live births)		Death rate (number per 100,000 estimated population)		
	Birth	Death	Births	Deaths	Births	Deaths		Infant mortality	Maternal mortality	Tuberculosis	Cancer	Motor vehicle accidents
1938	100.0	100.0	2,286,962	1,381,391	17.6	10.6	166	51.0	4.4	48.9	114.6	25.0
1937	100.0	100.0	2,203,337	1,450,427	17.0	11.2	152	54.4	4.9	53.6	112.0	30.7
1936	100.0	100.0	2,144,790	1,479,228	16.7	11.5	145	57.1	5.7	55.7	111.0	29.7
1935	100.0	100.0	2,155,105	1,392,752	16.9	10.9	155	55.7	5.8	55.0	107.9	28.5
1934	100.0	100.0	2,167,636	1,396,903	17.1	11.0	155	60.1	5.9	56.6	106.2	28.5
1933	100.0	100.0	2,081,232	1,342,106	16.5	10.7	155	58.1	6.2	59.5	102.2	24.9
1932	95.2	96.3	2,074,042	1,308,529	17.4	10.9	159	57.6	6.3	62.8	102.0	23.6
1931	94.7	96.3	2,112,760	1,322,587	18.0	11.1	160	61.6	6.6	68.1	98.9	27.1
1930	94.7	96.2	2,203,958	1,343,356	18.9	11.3	164	64.6	6.7	71.5	97.3	26.7
1929	94.7	95.7	2,169,920	1,386,303	18.9	11.9	157	67.6	7.0	76.0	95.9	25.7
1928	94.3	95.8	2,233,149	1,378,675	19.8	12.1	162	68.7	6.9	79.3	96.1	23.4

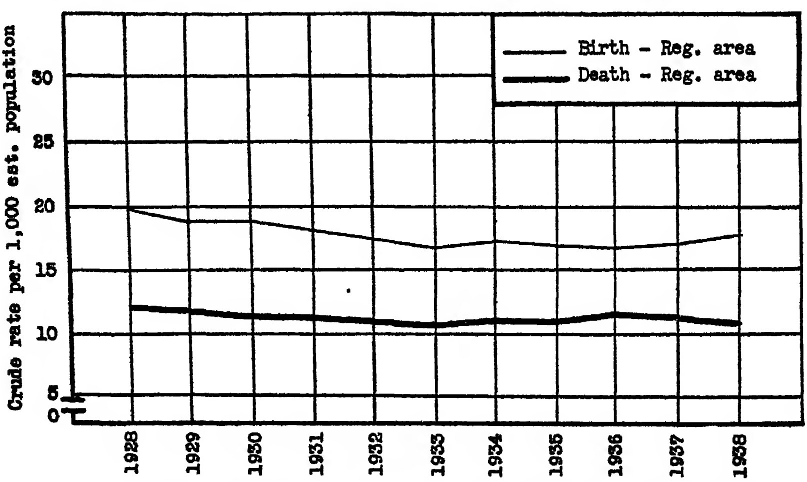

FIGURE 1.—Trends of crude birth and death rates in the United States registration areas, 1928–1938.

graphically the trends in the rates during that period. In 1938 there was a net natural increase of 7.0 per 1,000 population, the largest since 1930. The infant mortality rate has shown an interrupted decline from 68.7 in 1928 to 51.0 in 1938, while the maternal mortality rate has declined continuously during the 11-year period from 6.9 to 4.4.

In 1928 the death registration area in continental United States consisted of 42 States, the District of Columbia, and a number of cities in nonregistration States, while the birth registration area consisted of 40 States and the District of Columbia. Beginning with 1933 and since that year both areas have included the entire United States.

Table 2 summarizes the data for births, deaths, and infant mortality for 1937 and 1938 by States, and the rates by four classifications are presented graphically in the accompanying maps. In making comparisons by States, however, it must be borne in mind that the rates for different States are partly determined by the age, sex, and racial distributions of the population, and that the rates given are crude rates, which have not been adjusted for differences in these distributions.

The Bureau of the Census points out that the high death rates shown for Arizona and New Mexico, for example, are due in large measure to an excess in the number of nonresident deaths from tuberculosis; while those in the New England area result for the most part from the relatively advanced age of the population. The relatively low rates reported in some of the western and southern States result partly from the younger age composition of the population. Differences in public health conditions and the distribution of medical care also affect the death rates of the various States.

The variations in the birth rates are due to a combination of biological and social factors, such as race, age of population, and fertility; while differences in infant mortality are closely related to such factors as racial composition, standards of public health services, economic circumstances, and medical care.

The rates given for the country as a whole are computed on the estimated mid-year population for 1938, while the rates for each State are based on the estimated population for 1937, as no population estimates for States have been made by the Census Bureau for 1938. The death rates for the United States for certain selected causes, 1934–38, are shown in table 3.

Table 4 presents the numbers of births and deaths occurring by months and the monthly rates per 1,000 population.

In 1938 there were born 25,644 sets of twins, 262 sets of triplets, and 1 set of quadruplets, as compared with 24,881, 219, and 4, respectively, in 1937.

TABLE 2.—*Summary of natality, mortality, and infant mortality data for each State, 1937–38*

Area	Total births		Total deaths		Infant deaths		Rate per 1,000—					
							Estimated population				Live births	
							Births		Deaths		Infant deaths	
	1938	1937	1938	1937	1938	1937	1938[1]	1937	1938[1]	1937	1938	1937
United States	2, 286, 962	2, 203, 337	1, 381, 391	1, 450, 427	116, 702	119, 931	17. 6	17. 0	10. 6	11. 2	51. 0	54. 4
Alabama	62, 032	61, 611	29, 586	30, 843	3, 772	3, 844	21. 4	21. 3	10. 2	10. 7	60. 8	62 4
Arizona	10, 878	10, 494	6, 002	6, 919	1, 075	1, 207	26. 4	25. 5	14. 6	16. 8	98. 8	120. 7
Arkansas	37, 182	35, 236	16, 971	18, 364	1, 912	1, 919	18. 2	17. 2	8. 3	9. 0	51. 4	54. 5
California	101, 844	94, 230	76, 187	80, 256	4, 450	5, 070	16. 5	15. 3	12. 4	13. 0	43. 7	53. 8
Colorado	20, 599	19, 610	12. 615	13, 833	1, 240	1, 441	19. 2	18. 3	11. 8	12. 9	60. 2	73. 5
Connecticut	23, 783	22, 774	17, 582	17, 892	804	921	13. 7	13. 1	10. 1	10. 3	36. 3	40. 4
Delaware	4, 431	4, 355	3, 199	3, 290	234	278	17. 0	16. 7	12. 3	12. 6	52. 8	63. 8
Dist. of Columbia	12, 938	12, 343	7, 962	8, 727	622	751	20. 6	19. 7	12. 7	13. 9	48. 1	60. 8
Florida	31, 096	29, 507	21, 024	20, 960	1. 802	1, 765	18. 6	17. 7	12. 6	12. 6	57. 9	59. 8
Georgia	64, 636	64, 061	33, 783	34, 446	4, 376	3, 952	21. 0	20. 8	11. 0	11. 2	67. 7	61. 7
Idaho	11, 277	10, 369	4, 545	4, 752	503	453	22. 9	21. 0	9. 2	9. 6	44. 6	43. 7
Illinois	122, 562	115, 282	84, 769	87, 739	5, 016	4, 967	15. 6	14. 6	10. 8	11. 1	40. 9	43. 1
Indiana	60, 192	56, 087	38, 573	40, 929	2, 560	2, 789	17. 3	16. 1	11. 1	11. 8	42. 5	49. 7
Iowa	43, 221	42, 105	25, 623	26, 485	1, 752	1, 862	16. 9	16. 5	10. 0	10. 4	40. 5	44. 2
Kansas	29, 574	29, 325	18, 583	19, 204	1, 272	1, 302	15. 9	15. 7	10. 0	10. 3	43. 0	44. 4
Kentucky	61, 878	56, 163	29, 310	30, 890	3, 794	3, 321	21. 2	19. 2	10. 0	10. 6	61. 3	59. 1
Louisiana	48, 867	46, 006	24, 767	25, 010	3, 278	3, 020	22. 9	21. 6	11. 6	11. 7	67. 1	65. 6
Maine	15, 218	15, 240	10, 507	11, 465	856	996	17. 8	17. 8	12. 3	13. 4	56. 2	65. 3
Maryland	29, 013	27, 739	20, 847	22, 083	1, 616	1, 705	17. 3	16. 5	12. 4	13. 2	55. 7	61. 5
Massachusetts	61, 262	61, 736	49, 006	52, 248	2, 446	2, 723	13. 8	13. 9	11. 2	11. 8	39. 9	44. 1
Michigan	96, 963	91, 539	50, 687	53, 472	4, 320	4, 386	20. 1	19. 0	10. 5	11. 1	44. 6	47. 9
Minnesota	50, 062	48, 036	26, 179	26, 905	1, 940	1, 961	18. 9	18. 1	9. 9	10. 1	38. 8	40. 8
Mississippi	53, 694	52, 095	22, 800	23, 856	3, 042	3, 066	26. 5	25. 8	11. 3	11. 8	56. 7	58. 9
Missouri	58, 567	56, 951	42, 558	44, 974	3, 018	3, 219	14. 7	14. 3	10. 7	11. 3	51. 5	56. 5
Montana	10, 673	10, 248	5, 684	6, 128	486	518	19. 8	19. 0	10. 5	11. 4	45. 5	50. 5
Nebraska	22, 401	22, 270	11, 964	13, 199	815	937	16. 4	16. 3	8. 8	9. 7	36. 4	42. 1
Nevada	1, 888	1, 742	1, 272	1, 322	90	70	18. 7	17. 2	12. 6	13. 1	47. 7	40. 2
New Hampshire	7, 830	7, 633	6, 400	6, 528	373	367	15. 4	15. 0	12. 5	12. 8	47. 6	48. 1
New Jersey	56, 043	54, 607	43, 831	45, 003	2, 216	2, 154	12. 9	12. 6	10. 1	10. 4	39. 5	39. 4
New Mexico	14, 290	13, 837	5, 962	6, 422	1, 554	1, 711	33. 9	32. 8	14. 1	15. 2	108. 7	123. 7
New York	189, 559	185, 502	147, 106	153, 772	7, 693	8, 369	14. 6	14. 3	11. 4	11. 9	40. 6	45. 1
North Carolina	79, 934	79, 080	33, 599	33, 981	5, 487	5, 180	22. 9	22. 6	9. 6	9. 7	68. 6	65. 5
North Dakota	13, 041	12, 637	5, 208	5, 440	649	662	18. 5	17. 9	7. 4	7. 7	49. 8	52. 4
Ohio	112, 667	107, 576	74, 809	80, 189	4, 878	5, 332	16. 7	16. 0	11. 1	11. 9	43. 3	49. 6
Oklahoma	44, 188	41, 456	19, 957	21, 313	2, 167	2, 345	17. 3	16. 3	7. 8	8. 4	49. 0	56. 6
Oregon	16, 245	15, 457	11, 784	12, 341	636	642	15. 8	15. 1	11. 5	12. 0	39. 2	41. 5
Pennsylvania	165, 984	161, 288	107, 282	114, 949	7, 623	8, 109	16. 3	15. 8	10. 5	11. 3	45. 9	50. 3
Rhode Island	10, 536	10, 240	8, 276	8, 334	462	487	15. 5	15. 0	12. 2	12. 2	43. 8	47. 6
South Carolina	41, 120	40, 643	20, 718	20, 540	3, 303	3, 074	21. 9	21. 7	11. 0	11. 0	80. 3	75. 6
South Dakota	11, 826	11, 908	5, 482	5, 959	518	608	17. 1	17. 2	7. 9	8. 6	43. 8	51. 1
Tennessee	53, 651	51, 938	29, 268	30, 232	3, 405	3, 171	18. 5	18. 0	10. 1	10. 5	63. 5	61. 1
Texas	121, 156	116, 057	60, 208	65, 448	7, 889	8, 575	19. 6	18. 8	9. 8	10. 6	65. 1	73. 9
Utah	13, 214	12, 693	4, 853	4, 989	618	520	25. 5	24. 5	9. 4	9. 6	46. 8	41. 4
Vermont	6, 301	6, 326	4, 501	4, 931	305	313	16. 5	16. 5	12. 0	13. 0	48. 4	49. 5
Virginia	53. 495	51, 950	29, 579	31, 119	3, 540	3, 619	19. 8	19. 2	10. 9	11. 5	66. 2	69. 7
Washington	26, 767	25, 036	18, 528	19, 004	1, 035	908	16. 1	15. 1	11. 2	11. 5	38. 7	39. 9
West Virginia	42, 434	42, 240	17, 766	19, 190	2, 643	2, 610	22. 8	22. 6	9. 5	10. 3	62. 3	61. 8
Wisconsin	55, 004	53, 543	30, 704	31, 973	2, 301	2, 324	18. 8	18. 3	10. 5	10. 9	41. 8	43. 4
Wyoming	4, 946	4, 530	2, 235	2, 430	256	252	21. 0	19. 3	9. 5	10. 3	51. 8	55. 6

[1] Rate for each State is based on the 1937 estimated population; no estimate made for 1938.

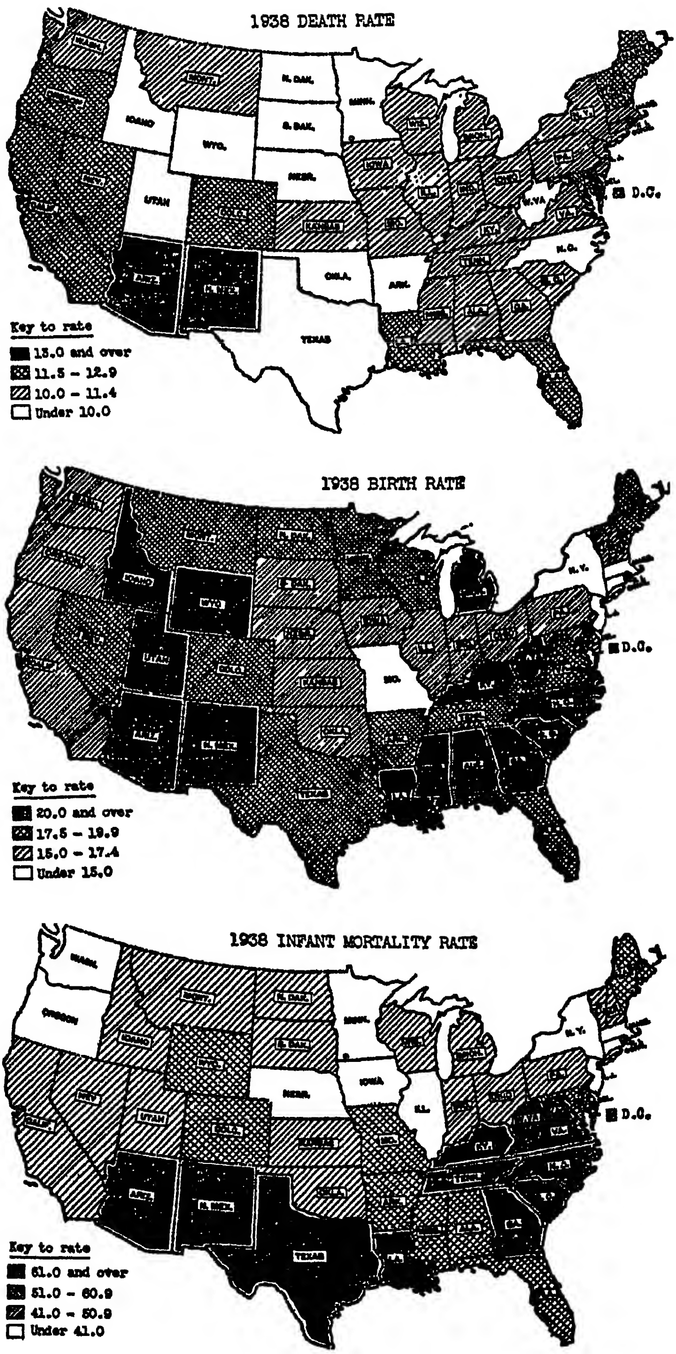

FIGURE 2.—Death, birth, and infant mortality rates, shown by four rate classifications by States.

TABLE 3.—*Death rates for selected causes, United States, 1934–38*

Cause of death [1]	Death rate (number per 100,000 estimated population)				
	1938	1937	1936	1935	1934
All causes	1,060.9	1,122.1	1,151.8	1,092.2	1,103.2
Typhoid and paratyphoid fever (1, 2)	1.9	2.1	2.5	2.8	3.3
Measles (7)	2.5	1.2	1.0	3.1	5.5
Scarlet fever (8)	.9	1.4	1.9	2.1	2.0
Whooping cough (9)	3.7	3.9	2.1	3.7	5.9
Diphtheria (10)	2.0	2.0	2.4	3.1	3.3
Influenza (11)	12.7	29.4	26.3	22.1	17.3
Dysentery (13)	2.3	2.3	2.4	1.9	2.7
Erysipelas (15)	.5	1.0	1.6	1.7	1.5
Acute poliomyelitis and acute polioencephalitis (16)	.4	1.1	.6	.8	.7
Epidemic cerebrospinal meningitis (18)	.8	1.7	2.4	2.1	1.0
Tuberculosis of the respiratory system (23)	44.6	49.0	50.6	49.8	51.1
Tuberculosis (all other forms) (24–32)	4.4	4.6	5.0	5.2	5.5
Syphilis (34)	9.7	10.2	9.8	9.1	9.3
Malaria (38)	1.8	2.1	3.1	3.5	3.6
Cancer of digestive tract and peritoneum (46)	54.4	53.6	53.1	52.1	51.7
Cancer of uterus, other female genital organs (48, 49)	15.5	15.5	15.4	15.1	14.9
Cancer of the breast (50)	11.1	10.8	10.7	10.4	10.4
Cancer (all other forms) (45, 47, 51–53)	33.6	32.1	31.8	30.4	29.1
Acute rheumatic fever (56)	1.6	1.5	1.7	1.8	1.8
Chronic rheumatism, osteoarthritis (57)	1.3	1.4	1.4	1.3	1.3
Diabetes mellitus (59)	23.8	23.7	23.7	22.2	22.1
Pellagra (62)	2.5	2.5	2.9	2.8	2.8
Alcoholism (acute or chronic) (75)	2.0	2.6	2.9	2.6	2.9
Progressive locomotor ataxia (tabes dorsalis), general paralysis of insane (80, 83)	4.1	3.9	4.2	4.3	4.7
Cerebral hemorrhage, cerebral embolism and thrombosis (82)	85.7	86.5	90.8	85.5	85.4
Chronic rheumatic heart diseases (90a, 92c, 93e, 95c)	7.2	5.8			
Diseases of coronary arteries and angina pectoris (94)	59.5	54.0	265.8	244.9	239.9
Heart diseases (all other forms) (90b, 91, 92a, b, 93a–d, 95a, b)	202.2	208.3			
Arteriosclerosis (except coronary), idiopathic anomalies of blood pressure (97, 102)	17.1	17.8	18.6	17.5	18.5
Pneumonia (all forms) (107–109)	67.5	85.1	93.0	81.9	79.4
Ulcer of stomach and duodenum (117)	6.5	6.8	6.7	6.6	6.1
Diarrhea and enteritis (under 2 years) (119)	10.8	11.1	12.2	10.4	13.4
Diarrhea and enteritis (2 years and over) (120)	3.4	3.5	4.2	3.7	4.9
Appendicitis (121)	11.0	11.9	12.8	12.7	14.3
Hernia, intestinal obstruction (122)	9.7	10.1	10.5	10.3	10.3
Cirrhosis of the liver (124)	8.3	8.5	8.2	7.9	7.7
Biliary calculi and other diseases of the gall bladder and biliary passages (126, 127)	6.5	6.7	6.9	6.7	7.0
Nephritis (130–132)	77.2	79.6	83.2	81.2	84.2
Puerperal septicemia (140, 142a, 145)	2.6	2.9	3.6	4.1	4.0
Puerperal albuminuria and eclampsia, other toxemias of pregnancy (146, 147)	1.9	2.1	2.2	2.1	2.4
Other puerperal causes (141, 142b–144, 148–150)	3.1	3.3	3.7	3.6	3.8
Congenital malformations (157)	9.3	9.2	9.4	9.3	10.0
Suicide (163–171)	15.2	14.9	14.2	14.3	14.9
Homicide (172–175)	6.8	7.6	8.0	8.3	9.5
Automobile accidents (primary) (210)	23.5	28.8	27.8	26.8	26.8
Other motor vehicle accidents (206, 208, 211)	1.5	1.9	1.8	1.7	1.7
Other accidents (176–195, 201–205, 207, 209, 212–214)	47.0	50.7	56.0	49.7	51.2
All other causes	139.5	145.5	152.6	140.0	153.4

[1] Figures in parentheses are disease title numbers of the International List of the Causes of Death, 1929.

TABLE 4.—*Number of births and deaths by month, United States, 1938*

Subject	January	February	March	April	May	June	July	August	September	October	November	December
Births:												
Number	194,557	180,052	196,177	184,263	188,010	183,822	203,183	205,742	196,692	192,035	179,917	182,512
Rate	17.6	18.0	17.7	17.2	17.0	17.2	18.4	18.6	18.4	17.4	16.8	16.5
Deaths:												
Number	131,369	115,621	125,980	117,322	116,329	107,192	107,852	106,288	103,027	112,636	112,055	125,720
Rate	11.9	11.6	11.4	11.0	10.5	10.0	9.8	9.6	9.6	10.2	10.5	11.4

TABLE 5.—*Number of births, deaths, and infant deaths (under 1 year of age), by race and sex, United States, 1938*

Subject	Total	White		Negro		Other races	
		Male	Female	Male	Female	Male	Female
Births	2,286,962	1,030,398	975,557	135,328	132,372	6,815	6,492
Deaths	1,381,391	605,559	529,872	94,659	83,911	4,084	2,703
Infant deaths	116,702	54,000	40,395	11,603	9,252	769	593

TABLE 6.—*Number of deaths under 1 year, by age, registration area*

Year	Number					Percent of total			
	Total deaths under 1 year	Under 1 day	Under 1 week	Under 1 month	Under 6 months	Under 1 day	Under 1 week	Under 1 month	Under 6 months
1938: Total	116,702	32,348	54,250	67,735	99,203	27.7	46.5	58.0	85 0
White	94,485	27,910	46,054	56,758	81,218	29.5	48.7	60.1	86.0
Negro	20,855	4,270	7,857	10,500	17,000	20.5	37.7	50 3	81.5
Other races	1,362	168	339	477	985	12.3	24.9	35.0	72.3
1937	119,931	32,413	54,491	68,887	101,881	27.0	45.4	57.4	84.9
1936	122,535	32,297	55,210	69,869	103,781	26.4	45.1	57.0	84.7
1935	120,138	32,237	54,877	69,834	102,252	26.8	45 7	58 1	85.1
1934	130,185	33,300	57,205	73,841	109,528	25.6	44 0	56.7	84.1
1933	120,887	31,413	54,744	70,658	102,237	26.0	45.3	58.4	84.6
1932	119,431	31,050	54,082	69,496	101,457	26.0	45.3	58.2	85.0
1931	130,134	31,786	55,958	73,092	109,005	24 4	43 0	56 2	83 8
1930	142,413	33,062	59,922	78,657	118,794	23 2	42 1	55.2	83 4
1929	146,661	33,258	60,869	80,063	121,572	22.7	41.5	54.6	82.9

Table 5 gives the number of births, deaths, and infant deaths (under 1 year of age), by race and sex, and table 6 shows the number and percentage of deaths under 1 year of age from 1929 to 1938, tabulated by certain subdivisions of the first year of life. Of the total infant deaths in 1938 nearly one-third occurred before the infant was 1 day old, nearly one-half under 1 week, and more than four-fifths under 6 months of age.

In table 7 are tabulated the infant deaths by important causes. For a single cause, premature birth stands highest in the list, while pneumonia, diarrhea and enteritis, and congenital malformations come next in the order named. These four causes were responsible for 70,456, or 60 percent, of the 116,702 deaths of infants under 1 year of age in 1938.

The number of deaths from cancer according to principal anatomical site of the tumor are given in table 8 for 1938 and certain prior years.

The cancer death rate in the United States has increased from 104.1 in 1934 and 112.0 in 1937 to 114.6 in 1938 (table 3). Some of the increase in cancer mortality over a period of years is undoubtedly due to the aging of the population. The death rate for cancer for any particular State or locality is partly determined by the age dis-

tribution in that area. It shows considerable variation in the different States, some of which may be accounted for by factors other than age distribution.

TABLE 7.—*Number of deaths under 1 year from selected causes, by age, United States, 1938*

Cause of death	Total deaths under 1 year	Under 1 day	1 day	2 days	3-6 days	1 week	2 weeks	3 weeks	Under 1 month	1-12 months
All causes	116,702	32,348	8,302	5,231	8,369	6,000	4,005	3,480	67,735	48,967
Measles (7)	718	2	3	2	3	8	16	23	57	661
Scarlet fever (8)	53				1	2	1	1	5	53
Whooping cough (9)	3,095				1	12	52	112	177	2,918
Diphtheria (10)	234	1		1	4	4	5	3	18	216
Influenza (11)	2,120	4	3	5	31	49	62	66	220	1,900
Dysentery (13)	1,146		1		2	13	19	22	57	1,089
Erysipelas (15)	154			1	3	7	13	16	40	114
Encephalitis (lethargic or epidemic) (17)	16					1			1	15
Meningitis (epidemic cerebrospinal) (18)	196				2	2	1	2	7	189
Tetanus (22)	143		1	6	38	71	6	4	126	17
Tuberculosis of respiratory system (23)	246	1				1	1	2	5	241
Tuberculosis of meninges (24)	201			1		1	3	2	7	194
Other forms of tuberculosis (25-32)	123						1	1	2	121
Syphilis (34)	1,444	231	64	47	86	86	56	57	627	817
Purulent infection, septicemia (36)	137				8	6	18	12	44	93
Malaria (38)	201	3	3	1	3	7	6	7	30	171
Other infectious, parasitic diseases (1-6, 12, 14, 16, 19-21, 33, 35, 37, 39-44)	243	1		1	4	13	14	4	37	206
Rickets (63)	155	3	2	1	1	3	5	5	20	135
Diseases of the thymus gland (67)	1,050	101	77	74	108	64	41	42	507	543
Hemorrhagic conditions (70)	215	17	5	22	56	34	15	7	156	59
Anemias (71)	198	13	5	9	18	28	6	6	85	113
Encephalitis (nonepidemic) (78)	84	2	3		3	1	2	3	14	70
Meningitis (79)	558	1	1	5	11	14	17	16	65	493
Cerebral hemorrhage, cerebral embolism and thrombosis (82)	243	3	6	4	7	2	1	4	27	216
Convulsions (86)	400	20	28	35	67	45	18	10	223	177
Diseases of ear, mastoid process (89)	501				1	6	10	7	24	477
Other diseases of nervous system and sense organs (80, 81, 83-85, 87, 88)	212	10	8	3	17	14	6	6	64	148
Diseases of circulatory system (90-103)	475	11	8	10	26	30	21	15	121	354
Pneumonia (all forms) (107-109)	16,014	63	113	148	512	592	634	709	2,771	13,243
Other diseases of respiratory system (104-106, 110-114)	1,276	20	18	16	49	59	57	62	281	995
Diseases of buccal cavity and annexa, pharynx, tonsils (115)	257	1		1	1	10	14	9	36	221
Diseases of stomach (117, 118)	389	2	1	5	34	35	29	26	132	257
Diarrhea and enteritis (119)	11,415	10	21	22	118	282	435	430	1,319	10,096
Hernia (122a)	119		3	2	6	6	3	5	25	94
Intestinal obstruction (122b)	884	1	1	14	43	49	28	32	168	716
Peritonitis (cause not specified) (129)	149			1	5	7	13	14	40	109
Other diseases of digestive system (116, 121, 123-128)	210	2	2	4	15	18	7	11	59	151
Diseases of genitourinary system (130, 131, 133-139)	388	10	4	5	32	30	24	23	128	260
Diseases of skin, cellular tissue (151-153)	263	3			11	37	44	15	110	153
Congenital malformations (157)	10,338	2,403	820	743	1,284	882	490	427	7,109	3,229
Congenital debility (158)	3,229	635	198	132	258	224	194	162	1,803	1,426
Premature birth (159)	32,689	19,826	4,144	1,855	2,503	1,825	909	520	31,582	1,107
Injury at birth (160)	9,994	5,390	1,509	1,080	1,320	390	136	77	9,902	92
Other diseases of early infancy (161)	5,194	2,072	684	574	935	488	160	106	5,019	175
External causes (172-195, 201-214)	2,382	137	52	52	68	58	85	103	555	1,827
Unknown, ill-defined causes (199, 200)	6,379	1,274	508	341	652	467	310	268	3,820	2,559
All other causes (45-62, 64-66, 68, 69, 72-77, 154-156)	567	15	6	8	27	17	17	20	110	457

TABLE 8.—*Number of deaths from cancer, by sex and site: Registration area*

Cause of death	1938		1935		1930 [1]		1925 [1]		1920 [1]	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Cancers and other malignant tumors (45–53)	69, 857	79, 357	62, 933	74, 716	51, 777	63, 488	41, 865	53, 639	30, 933	41, 098
Cancer of the buccal cavity and pharynx (45)	4, 030	901	3, 982	923	3, 685	869	3, 475	759	2, 335	462
Lip	657	63	671	56	540	40	483	70	393	44
Tongue	943	172	878	108	800	147	749	117	609	69
Mouth	440	130	441	100	335	104	285	56	170	61
Jaw	718	192	776	223	811	240	888	223	856	204
Other and unspecified parts of buccal cavity	485	143	406	134	411	109	205	76	211	56
Pharynx	787	201	750	203	788	223	775	217	90	28
Cancer of the digestive tract, peritoneum (46)	38, 126	32, 681	35, 224	31, 237	30, 431	27, 381	25, 375	24, 080	19, 058	19, 285
Esophagus	1, 952	546	1, 715	541	1, 464	432	1, 307	352	871	232
Stomach and duodenum	16, 288	10, 814	16, 077	11, 027	14, 847	10, 561	([2])	([2])	([2])	([2])
Intestines (except duodenum, rectum, anus)	7, 585	9, 103	6, 428	8, 037	4, 826	6, 170	([2])	([2])	([2])	([2])
Rectum and anus	4, 727	3, 718	3, 824	3, 237	2, 764	2, 431	2, 082	1, 959	1, 373	1, 443
Liver and biliary passages	4, 303	5, 763	4, 434	6, 045	4, 452	5, 936	4, 028	5, 530	3, 450	5, 193
Pancreas	2, 737	2, 169	2, 309	1, 809	1, 650	1, 313	991	911	665	515
Mysentery and peritoneum	511	529	424	526	398	497	349	471	259	425
Others under this title	23	39	13	15	24	41	25	45	20	34
Cancer of the respiratory system (47)	6, 065	2, 056	4, 478	1, 723	2, 688	1, 160	([2])	([2])	([2])	([2])
Larynx	1, 197	143	987	165	854	129	636	138	409	90
Lungs and pleura	3, 669	1, 631	2, 951	1, 405	1, 673	980	989	739	527	420
Other respiratory organs	1, 199	282	540	153	161	51	([2])	([2])	([2])	([2])
Cancer of the uterus (48)	------	16, 201	------	15, 853	------	14, 132	------	12, 377	------	9, 848
Cancer of other female genital organs (49)	------	3, 944	------	3, 345	------	2, 290	------	1, 674	------	949
Ovary and Fallopian tube	------	3, 312	------	2, 795	------	1, 833	------	1, 218	------	652
Vagina and vulva	------	577	------	509	------	409	------	398	------	247
Other female genital organs	------	55	------	41	------	48	------	58	------	50
Cancer of the breast (50)	145	14, 315	162	13, 064	138	10, 774	138	8, 378	88	6, 577
Cancer of the male genitourinary organs (51)	13, 539	------	11, 702	------	8, 661	------	([2])	------	([2])	------
Kidneys and suprarenals (male)	1, 414	------	1, 178	------	924	------	717	------	439	------
Bladder (male)	3, 210	------	3, 014	------	2, 512	------	2, 095	------	1, 494	------
Prostate	8, 069	------	6, 765	------	4, 648	------	3, 068	------	1, 597	------
Testes	482	------	412	------	270	------	227	------	143	------
Scrotum	32	------	34	------	30	------	16	------	([2])	------
Other male genitourinary organs	326	------	299	------	277	------	([2])	------	([2])	------
Cancer of the skin (52)	2, 039	1, 301	2, 113	1, 278	1, 852	1, 167	1, 636	988	1, 505	862
Cancer of other or unspecified organs (53)	5, 913	7, 808	5, 272	7, 293	4, 322	5, 715	([2])	([2])	([2])	([2])
Kidneys and suprarenals (female)	------	937	------	870	------	705	------	541	------	381
Bladder (female)	------	1, 535	------	1, 485	------	1, 172	------	913	------	650
Brain	977	646	654	487	467	337	223	200	96	88
Bones (except of jaw)	1, 134	977	889	875	858	753	591	558	343	406
Other or unspecified organs	3, 802	3, 773	3, 729	3, 576	2, 997	2, 748	([2])	([2])	([2])	([2])

[1] The percent of population included in the death registration area for 1920 was 82.3; 1925, 89.6; and 1930, 96.2.
[2] Not comparable.

In the distribution of puerperal mortality (maternal deaths per 1,000 live births) by cause, the toxemias of pregnancy stand the highest, with puerperal septicemia, septic conditions following abortion, other accidents of childbirth, and puerperal hemorrhage following in the order named. These five causes were responsible for 85 percent of the deaths of mothers due to puerperal causes in 1938.

TABLE 9.—*Number of deaths from puerperal causes and death rates, by race: United States, 1938*

Cause of death	Number				Death rate (number per 1,000 live births)			
	Total	White	Negro	Other races	Total	White	Negro	Other races
All puerperal causes (140–150)	9,953	7,566	2,305	82	4.4	3.8	8.6	6.2
Abortion with septic conditions (140)	1,380	1,070	302	8	.6	.5	1.1	.6
Accidents of pregnancy (141, 142b, 143)	898	678	209	11	.4	.3	.8	.8
Puerperal hemorrhage (144)	1,320	1,104	206	10	.6	.6	.8	.8
Puerperal septicemia (ex. 140) (142a, 145)	1,953	1,385	550	18	.9	.7	2.1	1.4
Toxemias of pregnancy (146, 147)	2,521	1,820	683	18	1.1	.9	2.6	1.4
Puerperal phlegmasia, etc. (148)	524	450	70	4	.2	.2	.3	.3
Other accidents of childbirth (149)	1,338	1,048	279	11	.6	.5	1.0	.8
Other puerperal causes (150)	19	11	6	2	(1)	(1)	(1)	.2

[1] Less than 1/10 of 1 percent per 1,000 live births.

TABLE 10.—*Number of deaths from motor vehicle accidents, by day of accident: United States, 1938*

Type of accident	Total	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Unk.
Total	32,582	6,203	3,781	3,321	3,498	3,602	4,009	6,294	1,874
Railroad and automobile (206)	1,489	252	200	140	189	193	208	238	56
Street car and automobile (208)	165	29	17	12	15	10	37	39	6
Automobile (210)	30,564	5,833	3,520	3,129	3,258	3,367	3,720	5,950	1,787
Motorcycle (211)	364	89	35	34	36	32	46	67	25

The number of deaths due to motor vehicle accidents, by days of the week, shows a preponderance of such deaths occurring during the week end, as might be expected, the largest numbers in 1938 occurring on Saturday and Sunday and the lowest on Tuesday. The death rate for automobile accidents in the United States for 1938 (23.5 per 100,000 population) was the lowest since 1933 (23.3). In 1937 the rate was 28.8.

SOURCES OF INFECTION IN CASES OF TRICHINOSIS IN SAN FRANCISCO

A recent news release by Dr. J. C. Geiger, director, Department of Public Health, city and county of San Francisco, gives interesting information concerning the sources of infection in cases of trichinosis in San Francisco during the 11-year period 1929 to 1939, inclusive. The type of pork involved and the number of cases were as follows:

Kind of pork involved	*Number of cases*
Pork sausage	58
Salami	54
Mettwurst	30
Fresh pork	36
Ground pork and meat loaf	11
Raw pork	8
Pork chops or steaks	5
Ham	4

Other types of pork involved were imported sausage, head cheese. mixed Chinese pork food, pickled pork, raw bacon, and smoked pork, In 13 cases, it was not possible to ascertain the kind of pork responsible. In 7 cases, infection was acquired from bear meat.

A relatively large number of cases were traced to salami and mettwurst, products which are customarily eaten without cooking by the consumer. Dr. Geiger reports that in 1934 many of the cases were traced to salami and that control measures were instituted for the preparation and sale of this product. Products of this sort constitute very dangerous avenues for trichina infection unless such products are prepared in packing houses or establishments operating under the Federal meat inspection regulations or equivalent regulations. The Federal regulations provide for the processing of the pork contained in products customarily eaten without cooking by the consumer so that any trichina parasites contained in the pork are rendered nonviable and incapable of causing trichinosis.

The Department of Public Health of San Francisco has been very diligent in its attempts to control trichinosis. Control regulations provide for the display of placards in butcher shops and in the kitchens of restaurants and hotels urging the thorough cooking of pork, supervision over hog ranches supplying pork to the San Francisco abattoirs, and a laboratory check on fresh pork slaughtered in such establishments. These attempts are reflected in a reduction during the past 5 years of cases of trichinosis occurring in the city.

COURT DECISION ON PUBLIC HEALTH

Inspection by city health officer of bakeries outside of city limits held unauthorized.—(Texas Court of Criminal Appeals; *Ex parte Ernest*, 136 S.W.2d 595; decided December 20, 1939; rehearing denied February 21, 1940.) An ordinance of the city of Winters, among other things, required an inspection by the city health officer of a bakery before the granting of a permit for the sale by it in the city of bread and certain other bakery products. For a bakery located within the corporate limits of the city the permit, license, and inspection fee was $12.50, while for a bakery outside the said limits there was to be added, to the fee of $12.50, $2.40 for each mile that such bakery was distant from the city.

A habeas corpus proceeding was brought by one charged with having unlawfully sold and delivered bread prepared in a bakery located in Fort Worth, Tex., the owner of which had not obtained from the health officer of Winters a permit to sell or deliver such bread within the city as provided by the ordinance. The court of criminal appeals said that the only question involved was whether

the city of Winters, by ordinance, could require bakeries located in Fort Worth and elsewhere to pay to the authorities of Winters the sum of $2.40 per mile. The conclusion reached by the court was that the ordinance in question, insofar as it authorized the health officer of Winters to enter the domain of another city to inspect bakeries located therein and require the operator thereof to pay an inspection fee of $2.40 per mile as a prerequisite to sell its bread in Winters, was void because the city had no power, under any legislative grant, to pass such an ordinance. The court pointed out that the jurisdiction of an incorporated city was ordinarily limited to its boundaries, unless the legislature expressly granted it extraterritorial powers, and observed that it was obvious that the city of Winters, by the ordinance in question, was attempting to exercise extraterritorial jurisdiction over bakeries located outside of its territory when the legislature had neither expressly nor impliedly granted any such power or authority.

DEATHS DURING WEEK ENDED MAY 4, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended May 4, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,458	8,117
Average for 3 prior years	8,268	
Total deaths, first 18 weeks of year	166,713	166,756
Deaths under 1 year of age	491	469
Average for 3 prior years	513	
Deaths under 1 year of age, first 18 weeks of year	9,193	9,727
Data from industrial insurance companies:		
Policies in force	65,621,233	67,459,306
Number of death claims	12,312	15,602
Death claims per 1,000 policies in force, annual rate	9.8	12.1
Death claims per 1,000 policies, first 18 weeks of year, annual rate	10.6	11.7

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MAY 18, 1940

Summary

For the week ended May 18, slight increases are shown in the numbers of cases of diphtheria, measles, meningococcus meningitis, poliomyelitis, smallpox, and typhoid fever as compared with the preceding week, while slight decreases are recorded for influenza, scarlet fever, and whooping cough. However, both the current incidence and the total reported cases to date of each of these nine diseases, except influenza and poliomyelitis, are below the 5-year (1935–39) median expectancy.

As compared with the preceding week, the number of cases of meningococcus meningitis increased from 45 to 64, with 11 cases reported in Pennsylvania (9 in Luzerne County), and 19 cases in New Mexico. The number of cases of poliomyelitis increased from 14 to 26, with 3 cases in Mississippi, 4 in California, and 7 cases in Washington State. The incidence of smallpox increased from 48 to 61 cases, of which 16 cases were reported in Colorado (7 last week) and 10 cases in Alabama, where none was reported last week. For the country as a whole the smallpox incidence remains unusually low, with a total of only 61 cases for the current week as compared with a 5-year median expectancy of 237, and with only 1,441 cases this year to date as compared with a median expectancy of 6,239.

Of 13 cases of Rocky Mountain spotted fever reported for the current week, 2 cases occurred in eastern States, which is probably indicative of the beginning of the seasonal rise of the disease in the East. Colorado reported 8 cases of Colorado tick fever. Of 18 cases of endemic typhus, 8 cases occurred in Texas and 5 cases in Georgia.

The Bureau of the Census reports 8,390 deaths in 88 large cities for the week ended May 18, as compared with 8,009 for the corresponding week last year and with 8,185 for the 3-year (1937–39) average.

Telegraphic morbidity reports from State health officers for the week ended May 18, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria, Week ended—, May 18, 1940	Diphtheria, Week ended—, May 20, 1939	Diphtheria, Median, 1935–39	Influenza, Week ended—, May 18, 1940	Influenza, Week ended—, May 20, 1939	Influenza, Median, 1935–39	Measles, Week ended—, May 18, 1940	Measles, Week ended—, May 20, 1939	Measles, Median, 1935–39	Meningitis, meningococcus, Week ended—, May 18, 1940	Meningitis, meningococcus, Week ended—, May 20, 1939	Meningitis, meningococcus, Median, 1935–39
NEW ENG.												
Maine	1	1	1	------	14	1	417	155	155	0	0	0
New Hampshire	0	0	0	------	------	------	7	3	34	0	0	0
Vermont	0	0	0	------	------	------	1	83	83	0	0	0
Massachusetts	6	7	6	------	------	------	766	1, 254	716	1	4	4
Rhode Island	0	1	1	------	------	------	162	80	80	0	1	0
Connecticut	3	2	2	------	3	3	35	832	233	0	1	1
MID. ATL.												
New York	18	25	28	[1] 14	[1] 9	[1] 7	923	2, 251	2, 876	5	5	10
New Jersey	8	10	12	5	7	7	887	67	845	1	0	2
Pennsylvania	15	22	23	------	------	------	498	138	1, 728	11	4	5
E. NO. CEN.												
Ohio	16	5	12	30	------	24	29	19	586	0	0	6
Indiana	3	7	10	1	33	14	13	11	229	0	1	2
Illinois	15	22	37	2	17	29	203	54	346	0	0	4
Michigan [2]	3	8	12	2	4	------	802	564	504	0	0	0
Wisconsin	2	1	2	44	48	53	1, 065	816	816	0	1	1
W. NO. CEN.												
Minnesota	3	2	2	9	3	1	89	266	370	0	0	0
Iowa	4	2	6	------	1	------	284	152	152	2	0	1
Missouri	5	5	12	2	------	36	31	7	48	1	1	1
North Dakota	1	0	0	2	81	3	3	56	15	0	0	0
South Dakota	3	1	0	------	2	------	1	240	5	0	0	0
Nebraska	5	1	1	------	------	------	12	213	213	0	0	2
Kansas	3	4	6	1	3	4	453	79	79	1	1	1
SO. ATL.												
Delaware	0	1	1	------	------	------	4	11	14	0	0	0
Maryland [2] [3]	1	1	5	4	3	3	5	318	318	1	0	2
Dist. of Col	2	1	10	------	------	------	3	391	107	0	0	2
Virginia	11	6	7	108	107	------	203	861	502	6	0	5
West Virginia [3]	7	5	5	16	26	24	30	2	78	0	1	4
North Carolina [3]	6	6	14	2	------	3	107	472	272	[6] 1	0	2
South Carolina [4]	5	7	2	179	306	72	31	11	13	0	1	0
Georgia [4]	2	4	4	40	149	------	109	132	0	0	0	1
Florida	3	1	2	2	16	3	83	97	25	0	0	0
E. SO. CEN.												
Kentucky	4	10	7	46	9	9	152	30	158	0	1	9
Tennessee	4	2	4	45	58	42	166	57	57	3	0	2
Alabama [4]	3	8	8	53	188	49	100	176	122	1	0	0
Mississippi [2] [4]	6	5	5	------	------	------	------	------	------	4	0	0
W. SO. CEN.												
Arkansas	3	4	5	34	29	20	52	142	73	0	3	0
Louisiana	7	13	12	7	4	6	14	67	37	1	0	1
Oklahoma	8	6	5	28	60	60	15	224	86	1	0	1
Texas [4]	28	23	35	199	410	211	1, 580	432	325	4	3	3
MOUNTAIN												
Montana [3]	0	8	2	10	69	45	78	153	62	0	0	0
Idaho [3]	1	0	0	------	------	3	19	131	23	0	1	0
Wyoming [3]	0	0	0	------	------	------	28	83	23	0	0	0
Colorado [3] [5]	6	8	6	4	4	------	78	237	237	0	2	0
New Mexico	0	0	1	8	1	9	99	10	44	19	1	0
Arizona	2	0	0	53	47	27	187	13	18	0	0	0
Utah [2]	0	0	0	------	3	------	607	151	52	0	0	0
PACIFIC												
Washington	0	0	1	------	------	------	486	1, 067	414	0	0	1
Oregon [3]	4	3	3	15	35	19	503	78	78	0	0	0
California	11	35	26	49	40	44	420	2, 513	1, 714	2	2	4
Total	238	233	370	1, 014	1, 849	871	11, 840	15, 205	15, 205	65	34	102
20 weeks	6. 650	8, 751	10, 388	163, 176	145, 395	134, 728	150, 987	273, 815	273, 815	[6] 823	968	2, 843

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 18, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	May 18, 1940	May 20, 1939		May 18, 1940	May 20, 1939		May 18, 1940	May 20, 1939		May 18, 1940	May 20, 1939	
NEW ENG.												
Maine	0	0	0	8	11	21	0	0	0	1	1	1
New Hampshire	0	0	0	0	4	11	0	0	0	0	0	0
Vermont	0	0	0	8	5	7	0	0	0	0	0	0
Massachusetts	1	0	0	189	153	218	0	0	0	3	2	2
Rhode Island	0	0	0	7	4	19	0	0	0	1	1	0
Connecticut	0	0	0	107	53	86	0	0	0	0	1	1
MID. ATL.												
New York	0	0	1	1,042	554	774	0	0	0	11	3	8
New Jersey	0	0	0	388	229	181	0	0	0	1	3	3
Pennsylvania	2	0	0	389	295	413	0	0	0	16	4	5
E. NO. CEN.												
Ohio	0	0	0	351	274	274	0	3	0	0	10	5
Indiana	0	0	0	85	137	115	4	29	19	3	3	3
Illinois	0	2	1	744	394	570	1	17	16	4	6	6
Michigan [2]	0	0	0	385	460	384	1	4	4	2	4	4
Wisconsin	0	0	0	130	128	309	1	3	3	0	2	1
W. NO. CEN.												
Minnesota	0	0	0	70	76	137	1	8	8	0	1	0
Iowa	1	0	0	41	77	96	5	26	26	0	1	1
Missouri	1	0	0	52	68	127	0	20	24	2	0	3
North Dakota	0	0	0	12	17	24	1	2	3	0	0	0
South Dakota	0	0	0	5	11	25	1	16	11	0	0	0
Nebraska	0	0	0	10	25	56	0	5	9	0	0	0
Kansas	0	1	0	49	47	98	1	6	6	1	1	3
SO. ATL.												
Delaware	0	0	0	4	6	6	0	0	0	0	1	0
Maryland [2 3]	0	0	0	49	30	43	0	0	0	0	2	2
Dist. of Col.	0	0	0	33	12	14	0	0	0	0	0	0
Virginia	0	0	1	31	18	17	0	0	0	2	5	5
West Virginia [2]	1	0	0	38	25	35	0	0	0	6	0	5
North Carolina [3]	1	0	1	22	10	17	0	0	0	0	8	4
South Carolina [4]	0	28	0	2	3	3	0	0	0	1	3	3
Georgia [4]	0	0	0	16	13	14	2	2	0	5	6	10
Florida	0	1	1	6	10	4	0	0	0	2	18	6
E. SO. CEN.												
Kentucky	1	0	0	49	47	25	1	1	1	5	10	5
Tennessee	0	1	1	65	57	17	1	7	0	5	2	4
Alabama [4]	0	0	0	7	6	5	10	0	0	7	11	6
Mississippi [2 4]	3	0	0	7	3	5	2	1	1	2	0	2
W. SO. CEN.												
Arkansas	0	2	0	6	10	4	1	16	5	2	2	2
Louisiana	0	1	1	6	16	7	0	1	0	7	15	13
Oklahoma	0	0	0	6	16	16	0	33	4	2	5	5
Texas [4]	0	3	1	33	32	46	5	4	8	5	7	14
MOUNTAIN												
Montana	0	0	0	19	12	12	0	0	8	1	2	1
Idaho [3]	0	0	0	10	2	8	0	0	3	1	0	0
Wyoming [3]	0	0	0	5	5	5	0	1	1	0	0	0
Colorado [3 5]	1	0	0	38	30	58	16	3	3	3	1	1
New Mexico	0	0	0	2	7	7	0	3	0	1	0	0
Arizona	0	0	0	9	12	12	0	5	0	1	1	3
Utah [2]	2	0	0	20	30	30	0	0	0	1	2	0
PACIFIC												
Washington	7	0	0	46	56	48	0	1	7	0	0	1
Oregon [2]	1	0	0	8	18	22	1	8	8	1	2	3
California	4	3	3	134	164	210	6	12	12	5	9	9
Total	26	42	19	4,743	3,672	5,616	61	237	237	110	150	154
20 weeks	465	418	412	96,417	97,895	134,892	1,441	7,015	6,239	1,670	2,360	2,360

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 18, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended— May 18, 1940	Whooping cough, Week ended— May 20, 1939
NEW ENG.		
Maine	22	48
New Hampshire	14	4
Vermont	27	22
Massachusetts	176	119
Rhode Island	9	86
Connecticut	33	41
MID. ATL.		
New York	322	409
New Jersey	112	275
Pennsylvania	276	297
E. NO. CEN.		
Ohio	203	71
Indiana	35	44
Illinois	110	198
Michigan [2]	215	156
Wisconsin	135	170
W. NO. CEN.		
Minnesota	51	27
Iowa	30	26
Missouri	19	16
North Dakota	2	16
South Dakota	1	2
Nebraska	8	43
Kansas	30	32
SO. ATL.		
Delaware	6	8
Maryland [2] [3]	127	29
Dist. of Col.	5	15
Virginia	57	45
West Virginia [2]	50	21
SO. ATL.—continued		
North Carolina [3]	112	218
South Carolina [4]	21	105
Georgia [4]	28	78
Florida	11	57
E. SO. CEN.		
Kentucky	115	14
Tennessee	45	22
Alabama [4]	16	65
Mississippi [2] [4]		
W. SO. CEN.		
Arkansas	11	32
Louisiana	24	42
Oklahoma	26	2
Texas [4]	306	184
MOUNTAIN		
Montana [3]	2	28
Idaho [3]	23	7
Wyoming [3]	3	2
Colorado [3] [5]	13	47
New Mexico	48	19
Arizona	23	11
Utah [2]	217	72
PACIFIC		
Washington	43	15
Oregon [3]	8	34
California	501	283
Total	3,731	3,557
20 weeks	62,687	80,002

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Rocky Mountain spotted fever, week ended May 18, 1940, 13 cases as follows: Maryland, 1; North Carolina, 1; Montana, 2; Idaho, 2; Wyoming, 4; Colorado, 1; Oregon, 2.
[4] Typhus fever, week ended May 18, 1940, 18 cases as follows: South Carolina, 3; Georgia, 5; Alabama, 1; Mississippi, 1; Texas, 8.
[5] Colorado tick fever, week ended May 18, 1940, Colorado, 8 cases.
[6] Only 1 case of Meningococcus Menengitis in North Carolina, instead of 2 cases, should have been shown for the week ended May 11, 1940, Public Health Reports of May 17, p. 904.

WEEKLY REPORTS FROM CITIES

City reports for week ended May 4, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Data for 90 cities:											
5-year average	138	137	52	6,858	648	2,171	22	402	24	1,262	--------
Current week	74	103	27	2,878	385	2,108	2	343	11	975	--------
Maine:											
Portland	0	------	0	161	0	0	0	0	0	4	33
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	14
Manchester	0	------	0	3	2	4	0	1	0	0	14
Nashua	0	------	0	4	0	0	0	0	0	0	4
Vermont:											
Barre	0	------	0	0	2	0	0	0	0	0	2
Burlington	0	------	0	0	0	0	0	0	0	2	9
Rutland	0	------	0	0	1	0	0	0	0	0	3
Massachusetts:											
Boston	0	------	0	95	12	57	0	10	0	58	218
Fall River	0	------	0	43	0	1	0	0	0	6	22
Springfield	0	------	0	3	1	6	0	0	0	4	40
Worcester	0	------	0	37	7	7	0	0	0	1	44
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	17
Providence	1	------	0	107	3	10	0	2	0	17	62
Connecticut:											
Bridgeport	0	------	0	4	3	2	0	3	0	1	44
Hartford	2	------	0	0	6	16	0	0	0	1	52
New Haven	0	1	0	0	0	2	0	0	0	6	56
New York:											
Buffalo	0	------	1	1	13	12	0	6	0	3	142
New York	12	16	3	171	69	790	0	79	5	113	1,555
Rochester	1	2	0	6	1	12	0	1	0	9	74
Syracuse	0	------	0	0	4	14	0	0	0	6	53
New Jersey:											
Camden	0	------	0	0	0	9	0	1	0	0	27
Newark	0	------	0	463	2	26	0	1	0	28	75
Trenton	0	------	0	0	5	4	0	0	0	1	35
Pennsylvania:											
Philadelphia	0	1	0	69	19	128	0	24	2	40	509
Pittsburgh	1	10	1	5	8	35	0	11	0	15	174
Reading	1	------	0	1	1	0	0	0	0	14	17
Scranton	0	------	--------	1	-------	5	0	-------	0	0	--------
Ohio:											
Cincinnati	2	------	0	0	6	19	0	8	0	39	126
Cleveland	3	14	1	3	11	38	0	14	1	38	208
Columbus	0	------	0	2	1	12	0	0	0	8	81
Toledo	0	------	0	0	5	35	0	2	0	8	75
Indiana:											
Anderson	1	------	0	1	1	1	0	1	0	6	13
Fort Wayne	0	------	0	1	2	2	1	0	0	0	31
Indianapolis	4	------	1	2	15	21	0	4	0	8	112
Muncie	0	------	0	0	2	0	0	0	0	0	9
South Bend	1	------	--------	4	1	0	0	0	0	3	22
Terre Haute	0	------	0	0	0	2	0	1	0	0	19
Illinois:											
Alton	0	1	1	1	1	3	0	0	0	1	10
Chicago	13	3	2	65	29	490	0	29	0	32	706
Elgin	0	------	0	1	0	1	0	0	0	0	6
Moline	0	------	0	3	0	0	0	0	0	0	4
Springfield	0	------	0	1	3	3	0	0	0	8	29
Michigan:											
Detroit	0	------	1	133	9	86	0	11	0	48	238
Flint	0	------	0	9	11	26	0	2	0	10	45
Grand Rapids	0	------	0	2	0	20	0	0	0	27	39
Wisconsin:											
Kenosha	0	------	--------	58	-------	2	0	-------	0	0	--------
Madison	0	------	1	8	0	1	0	0	0	8	5
Milwaukee	0	------	0	49	4	29	0	2	0	0	104
Racine	0	------	0	4	0	3	0	1	0	0	14
Superior	0	------	0	107	0	3	0	0	0	0	11

City reports for week ended May 4, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	28	0	0	0	0	0	0	24
Minneapolis	1	------	0	1	3	15	0	0	0	5	86
St. Paul	0	1	1	2	8	8	0	2	0	5	66
Iowa:											
Cedar Rapids	0	------	------	56	------	0	0	------	0	0	------
Davenport	0	------	------	8	------	2	0	------	0	0	------
Des Moines	8	------	0	24	0	10	0	0	0	0	24
Sioux City	0	------	0	2	------	1	0	------	0	0	------
Waterloo	1	------	------	11	------	2	0	------	0	0	------
Missouri:											
Kansas City	2	------	0	10	6	12	0	5	0	1	94
St. Joseph	0	------	0	0	2	1	0	0	0	0	21
St. Louis	8	------	0	3	11	13	1	10	0	12	197
North Dakota:											
Fargo	0	------	0	0	2	0	0	0	0	0	5
Grand Forks	0	------	------	1	------	0	0	------	0	3	------
Minot	0	------	0	0	0	0	0	0	0	0	11
South Dakota:											
Aberdeen	0	------	------	0	------	2	0	------	0	0	------
Sioux Falls	0	------	0	0	0	1	0	0	0	0	2
Nebraska:											
Lincoln	0	------	------	1	------	1	0	------	0	2	------
Omaha	0	------	1	1	2	4	0	4	0	4	50
Kansas:											
Lawrence	0	------	0	1	0	0	0	0	0	0	4
Topeka	0	2	2	18	6	1	0	0	0	0	28
Wichita	0	1	0	15	3	0	0	0	0	8	29
Delaware:											
Wilmington	0	------	0	0	1	7	0	1	0	1	31
Maryland:											
Baltimore	0	8	0	0	12	11	0	16	0	127	213
Cumberland	0	------	0	0	1	0	0	0	0	0	12
Frederick	0	------	0	0	1	0	0	0	0	0	------
Dist. of Col.:											
Washington	0	------	0	8	7	35	0	23	1	4	180
Virginia:											
Lynchburg	1	------	0	2	0	1	0	1	0	9	19
Richmond	0	------	0	1	8	1	0	1	0	1	88
Roanoke	1	------	0	9	1	8	0	0	0	0	15
West Virginia:											
Charleston	0	------	0	0	1	0	0	0	0	0	14
Huntington	0	------	------	0	------	1	0	0	------	1	------
Wheeling	0	------	------	1	------	4	0	------	0	2	------
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	0	0	0	0	0	0	7
Wilmington	0	------	0	0	1	0	0	0	0	0	7
Winston-Salem	1	------	0	0	2	1	0	3	0	0	18
South Carolina:											
Charleston	0	13	0	0	1	1	0	0	0	0	15
Florence	0	------	0	0	2	0	0	0	0	0	12
Greenville	0	------	0	0	2	0	0	0	0	1	11
Georgia:											
Atlanta	0	------	1	6	6	3	0	2	0	0	80
Brunswick	0	------	0	0	0	0	0	0	0	0	5
Savannah	0	23	0	0	1	0	0	2	0	0	36
Florida:											
Miami	0	------	0	2	1	0	0	0	0	0	29
Tampa	0	1	1	55	0	1	0	1	0	0	21
Kentucky:											
Ashland	1	------	0	0	1	0	0	0	0	9	7
Covington	0	------	0	8	0	2	0	0	0	0	16
Lexington	0	------	0	10	0	3	0	1	0	5	18
Louisville	0	------	0	10	7	30	0	6	0	72	69
Tennessee:											
Knoxville	0	------	0	12	2	15	1	0	1	0	21
Memphis	0	1	3	21	0	12	0	1	0	9	85
Nashville	0	------	1	12	4	1	0	1	0	0	41
Alabama:											
Birmingham	0	2	0	5	2	2	0	5	0	1	64
Mobile	0	2	1	12	1	0	0	0	0	0	25
Montgomery	1	------	------	8	------	0	0	------	0	2	------

City reports for week ended May 4, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	3		0		0	0		0	0	
Little Rock	0	3	0	0	5	1	0	2	0	0	
Louisiana:											
Lake Charles	0		0	0	1	0	0	0	0	0	5
New Orleans	1	1	1	4	5	4	0	12	0	9	135
Shreveport	0		0	1	3	0	0	1	0	0	36
Oklahoma:											
Oklahoma City	0	1	0	1	1	0	0	1	0	0	28
Tulsa	1			1		3	0		0	35	
Texas:											
Dallas	1		0	363	3	1	0	3	0	33	66
Fort Worth	0		0	7	2	0	0	3	0	23	38
Galveston	0		0	0	2	1	0	1	0	0	13
Houston	3		0	22	3	6	0	3	0	7	91
San Antonio	0		1	22	5	1	0	4	0	1	72
Montana:											
Billings	0		0	0	0	0	0	0	0	0	7
Great Falls	0		0	20	0	3	0	0	0	0	5
Helena	0		0	0	0	1	0	0	0	0	3
Missoula	0		0	0	0	0	0	0	0	0	6
Idaho:											
Boise	0		0	1	0	0	0	0	0	1	3
Colorado:											
Colorado Springs	0		0	3	0	0	0	1	0	2	11
Denver	14		1	37	2	8	0	3	0	1	72
Pueblo	0		0	1	0	1	0	0	0	0	2
New Mexico:											
Albuquerque	0		0	0	1	0	0	3		5	11
Utah:											
Salt Lake City	0		1	237	1	3	0	0	0	77	40
Washington:											
Seattle	0		2	295	6	8	0	2	0	10	105
Spokane	0		0	22	2	5	0	0	1	1	32
Tacoma	0		0	8	1	4	0	0	0	2	24
Oregon:											
Portland	2		0	186	2	2	0	4	0	7	82
Salem	0			1		1	0		0	0	
California:											
Los Angeles	2	2	0	16	3	30	0	14	0	56	281
Sacramento	2	1	0	15	2	1	0	2	0	20	24
San Francisco	1		0	3	6	9	0	8	1	20	153

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
New Hampshire:			
Nashua	1	0	0
Massachusetts:			
Boston	1	0	0
Rhode Island:			
Pawtucket	1	1	0
Providence	1	0	0
New York:			
Buffalo	2	2	0
New York	4	2	0
Ohio:			
Toledo	1	0	0
Michigan:			
Detroit	1	1	0
Minnesota:			
Minneapolis	0	0	1
Missouri:			
St. Louis	1	0	0
Maryland:			
Baltimore	0	0	1
West Virginia:			
Huntington	1	0	0
North Carolina:			
Gastonia	0	0	1
Texas:			
Dallas	1	0	0
California:			
Los Angeles	1	1	0

Encephalitis, epidemic or lethargic.—Cases: San Francisco, 2.
Pellagra.—Cases: Charleston, S. C., 2; Savannah, 2; Miami, 1.
Rabies in man.—Deaths: Pittsburgh, 1.
Typhus fever.—Cases: New York, 2; Atlanta, 1; New Orleans, 1. Deaths: Atlanta, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended April 20, 1940.—During the week ended April 20, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				4	3			1		8
Chickenpox		1	4	233	352	34	14	7	54	699
Diphtheria			2	14	1	6		2		25
Dysentery				1						1
Influenza		24	1		187				7	219
Measles		16		189	500	684	269	2	114	1,774
Mumps		2		50	384	18	56	1	15	526
Pneumonia		19			17	5	5		4	50
Poliomyelitis				1						1
Scarlet fever		28	6	195	143	22	9	15	5	423
Tuberculosis	1	5	8	58	49	2				123
Typhoid and paratyphoid fever			14	5	2	5	1			27
Whooping cough		42		103	129	56	59	9	24	422

ITALY

Communicable diseases—4 weeks ended January 28, 1940.—During the 4 weeks ended January 28, 1940, cases of certain communicable diseases were reported in Italy as follows:

Disease	Jan. 1-7	Jan. 8-14	Jan. 15-21	Jan. 22-28
Anthrax	6	9	10	11
Cerebrospinal meningitis	27	48	39	44
Chickenpox	290	347	294	237
Diphtheria	564	610	577	552
Dysentery (amebic)	9	18	20	14
Dysentery (bacillary)			2	1
Hookworm disease	4	29	6	15
Lethargic encephalitis	1	1	1	2
Measles	717	878	785	950
Mumps	151	300	278	244
Paratyphoid fever	47	91	52	38
Poliomyelitis	24	42	26	12
Puerperal fever	13	26	35	26
Scarlet fever	147	208	195	213
Typhoid fever	246	295	261	224
Undulant fever	47	60	51	54
Whooping cough	165	302	319	446

JAMAICA

Communicable diseases—4 weeks ended April 13, 1940.—During the 4 weeks ended April 13, 1940, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	6	15	Puerperal fever		3
Diphtheria	6	3	Scarlet fever	1	3
Dysentery	6	22	Tuberculosis	17	73
Erysipelas		1	Typhoid fever	3	60
Poliomyelitis	1	8			

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of April 26, 1940, pages 745–749. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Hamakua Mill Area.—A rat found on April 17, 1940, near Paauilo, and another rat found on April 18, 1940, in Kukaiau, both in Hamakua Mill Area, Hamakua District, Island of Hawaii, T. H., have been proved positive for plague.

Smallpox

Ecuador—Guayaquil (vicinity of).—During the week ended May 4, 1940, 1 case of smallpox was reported in a town in the vicinity of Guayaquil, Ecuador.

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Public Health Reports

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IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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PREVALENCE OF POLIOMYELITIS IN THE UNITED STATES IN 1939

By C. C. DAUER, *Epidemiologist, District of Columbia Health Department*

In 1938 an unusually low incidence of poliomyelitis was recorded in all sections of the United States, during which time 1,705 cases (1.3 per 100,000 population) were reported and 487 deaths (0.4 per 100,000 population) were registered. In contrast to this low incidence of the disease in 1938, there was a sharp increase in the number of cases reported in 1939, 7,331 cases (preliminary figure) or a rate of 5.6. In 1939 the distribution of the disease was characterized by a number of localized outbreaks in various sections of the country in addition to a fairly widespread occurrence in the Mountain States. As indicated in table 1, there were four States in which the case rate was 20 or more per 100,000 population, namely, New Mexico (26.1), South Carolina (23.9), Arizona (22.4), and Minnesota (20.5). Three States had case rates between 15 and 20, namely, Michigan (19.1), Utah (19.0), and California (16.6). In 1939 a total of 15 States reported rates in excess of the maximum (4.3) recorded in 1938.

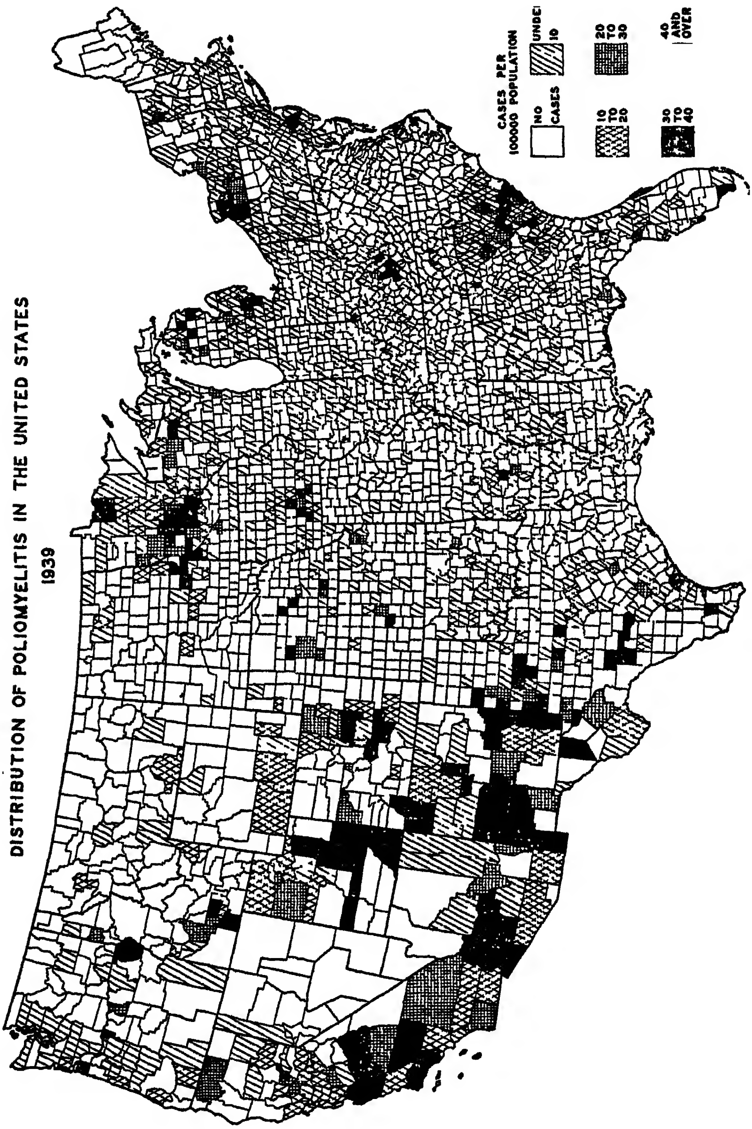
The distribution of poliomyelitis cases by counties for 1939 is shown in the accompanying map (fig. 1) in the preparation of which the same scale of rates was used as in previous reports (*1*, *2*). This map clearly shows the location of the areas in which the incidence was high. The most extensive area included a group of counties in Arizona, Utah, New Mexico, Colorado, and northwestern Texas. The second largest area extended across central Minnesota and included a few counties in northeastern South Dakota. Smaller groups of counties in which the incidence was high were located in Michigan, New York, South Carolina, Kentucky, Iowa, and south central California. Two adjoining counties in New Jersey, and Philadelphia, Pa., comprised a very small area in which the incidence of poliomyelitis was moderately high. In these 9 areas 56 counties had case rates of 40 or more per 100,000 population, and 43 had rates ranging between 30 and 40. In 7 of these areas of high rates one or more counties had excessively high incidence, i. e., a rate of 100 or more, as shown in table 2. Seven of the 13 counties in which the rates exceeded

100 were located in the Mountain section but 4 of these had small populations and reported only a few cases. In 9 of the 13 counties listed in table 2 there had been relatively few cases reported in the 5-year period immediately preceding 1939, and in the remaining 4 none had been reported. These 13 counties as a group have predominantly rural populations. However, three of them contained cities of 10,000 or more population according to the 1930 census, namely, Charleston in Charleston County, S. C., St. Cloud in Stearns

TABLE 1.—*Poliomyelitis case rates and death rates per 100,000 population by States, 1935–39*

Division and State	Case rates					Death rates			
	1935	1936	1937	1938	1939	1935	1936	1937	1938
United States	8.6	3.5	7.3	1.3	5.6	0.8	0.6	1.1	0.4
New England States:									
Maine	19.0	5.0	16.1	1.7	.5	1.7	.4	2.0	.4
New Hampshire	9.5	.8	4.9	.2	.8	2.2	.2	.2	0
Vermont	17.7	2.1	7.6	2.3	8.4	1.9	0	1.0	1.0
Massachusetts	32.0	1.3	7.9	.4	1.7	1.4	.3	.5	.2
Rhode Island	51.5	.7	3.2	.9	.4	3.4	.1	.1	.1
Connecticut	23.4	.9	6.2	1.2	1.6	1.5	.4	.7	0
Middle Atlantic States:									
New York	22.2	1.5	4.9	1.1	8.0	1.1	.2	.5	.2
New Jersey	11.8	.6	3.6	.9	5.3	.8	.2	.5	.2
Pennsylvania	2.2	1.3	3.3	.8	4.2	.3	.2	.4	.2
East North Central States:									
Ohio	1.3	5.1	7.9	.8	2.3	.5	.8	1.0	.3
Indiana	1.4	1.5	4.2	.4	1.6	.3	.5	.9	.3
Illinois	3.0	8.8	9.9	1.4	2.4	.5	1.0	1.1	.2
Michigan	13.0	3.2	9.0	1.2	19.1	.9	.5	1.2	.3
Wisconsin	2.2	1.5	11.4	1.7	3.8	.2	.2	1.3	.2
West North Central States:									
Minnesota	3.6	1.2	12.6	1.6	20.5	.5	.2	1.9	.4
Iowa	2.5	3.0	9.4	1.5	7.7	.3	.5	1.6	.3
Missouri	1.3	2.7	9.9	.6	.7	.4	.6	1.9	.4
North Dakota	1.7	2.7	.9	1.1	1.9	.4	.4	.3	.1
South Dakota	2.1	1.9	5.7	4.0	3.6	.9	.1	1.0	.3
Nebraska	.9	1.7	16.0	.7	3.6	.8	.8	3.4	.5
Kansas	1.5	5.0	12.9	.6	2.3	.5	.5	1.8	.1
South Atlantic States:									
Delaware	2.0	.4	3.1	.8	3.1	.4	.4	.4	.4
Maryland	6.4	2.2	4.8	1.0	1.6	.3	.2	1.0	.1
District of Columbia	14.3	1.1	4.8	4.3	3.0	1.0	.3	.6	.5
Virginia	23.7	2.2	2.4	2.0	1.8	1.0	.5	.5	.4
West Virginia	2.2	3.4	3.7	.8	3.5	.7	1.1	1.1	.8
North Carolina	19.8	1.5	3.1	1.4	3.3	2.1	.5	.8	.4
South Carolina	2.1	1.2	1.2	1.4	23.9	.7	.9	.7	.6
Georgia	.8	4.8	2.7	1.9	3.1	.6	1.1	.8	.7
Florida	1.0	2.5	1.8	1.8	4.0	.4	.4	.3	.4
East South Central States:									
Kentucky	11.5	3.1	4.4	1.3	5.9	1.6	1.2	1.0	1.1
Tennessee	3.2	13.2	4.4	1.1	1.1	1.0	1.5	1.0	.7
Alabama	2.1	14.6	2.9	3.4	1.5	.5	1.5	.6	.6
Mississippi	.8	9.5	21.0	3.4	1.3	.5	1.0	2.9	.9
West South Central States:									
Arkansas	.8	2.7	16.2	1.6	2.4	.4	.9	4.2	.8
Louisiana	4.8	1.6	6.2	2.0	.9	.6	.4	.9	.5
Oklahoma	.5	5.0	18.1	1.1	2.2	.4	1.4	2.8	.6
Texas	1.3	1.1	10.7	1.0	3.8	.8	.6	2.1	.7
Mountain States:									
Montana	1.1	2.6	5.8	2.6	1.1	.2	.9	1.1	.6
Idaho	.9	4.3	3.9	2.4	7.2	.6	1.2	1.0	.2
Wyoming	.9	3.0	16.7	.4	3.5	.9	.4	2.6	1.3
Colorado	2.1	6.3	19.4	1.3	13.0	1.1	1.4	3.7	.7
New Mexico	2.4	7.4	6.1	2.6	26.1	.9	1.7	1.7	.9
Arizona	6.1	3.4	6.8	2.2	22.4	2.0	1.2	1.0	.7
Utah	2.1	1.3	6.4	.8	19.0	.2	.2	1.7	0
Nevada	2.0	2.0	5.0	0	2.0	0	0	1.0	1.0
Pacific States:									
Washington	2.4	4.7	5.3	1.1	1.7	.4	1.0	.5	.2
Oregon	4.6	3.6	6.0	1.5	5.2	1.6	.9	.7	.6
California	13.7	6.4	11.5	2.2	16.6	1.1	.6	1.3	.3

County, Minn., and Batavia in Genesee County, N. Y. Approximately one-half of the cases occurring in the three counties were reported from the cities mentioned.



Several large cities also reported outbreaks of poliomyelitis of varying severity. Buffalo, Camden, N. J., Detroit, and Minneapolis reported the highest incidence, between 30 and 60 cases per 100,000

TABLE 2.—*Number of cases and case rates in certain counties in 1939 and 1934–38*

County	Population 1930	Number of cases reported 1939	Case rate per 100,000 population 1939	Number of cases reported 1934–1938	Average annual case rate per 100,000 population 1934–1938
Alcona County, Mich	4 989	11	220	1	4 0
Stearns County, Minn	62 131	[1] 113	182	5	1 6
St Cloud City	21 000	47	224	---------	---------
Madison County, Iowa	14 331	26	181	3	0 4
Genesee County, N Y	44, 408	[2] 80	180	6	2 7
Batavia City	17, 375	42	212	---------	---------
Sutton County, Tex	2, 807	4	179	0	0
Charleston County, S C	101, 050	[3] 179	177	13	2 5
Charleston City	62, 265	100	161	-------	---------
Floyd County, Ky	41 942	73	174	0	0
De Baca County, N Mex	2, 893	4	142	2	14 0
Roosevelt County, N Mex	11, 109	15	135	0	0
Carson County, Utah	17 798	23	129	3	3 4
Curry County, N Mex	15 809	18	114	8	1 1
San Juan County, Utah	3, 496	4	114	1	5 7
Grand County, Utah	1, 813	2	110	0	0

[1] Includes cases in St Cloud
[2] Includes cases in Batavia
[3] Includes cases in Charleston City.

population. Los Angeles, Philadelphia, St. Paul, and Rochester, N. Y., had milder outbreaks in which the rates ranged between 10 and 20. Each of the large cities listed above is located in the areas previously described.

As in previous years there were also isolated counties located in various parts of the country where the case rates were 30 or more per 100,000 population. In several of these counties in which the population is small, the occurrence of relatively few cases resulted in high rates.

Although data by counties are not available showing the occurrence of poliomyelitis by weeks, the weekly telegraphic reports of States and cities to the Public Health Service indicate that there was considerable variation in the time when outbreaks occurred in different areas. In South Carolina it was noted that a few sporadic cases occurred as far back as November and December 1938. This continued through January, February, and March, but in April there was a marked increase in the number of cases reported in Charleston and the remainder of the State. The peak of the epidemic in Charleston occurred in the middle of May but the greatest number of cases for the remainder of the State was reported during the week ended June 24. The decline in the number of cases for the city and State was gradual rather than abrupt. In Los Angeles cases began to appear late in June but the peak was not reached until the week ended September 2. However, the greatest number of cases reported in the State of California was for the week ended August 5. The outbreak began early in July in Detroit, and late in the month in Michigan, exclusive of Detroit. The peak of the outbreak was reported during the week ended August 26 in Detroit and a week

later in the remainder of the State. In the other areas of high incidence, the peaks of the outbreaks were reported in September and early October, except in Kentucky and Iowa where the largest number of cases was reported during the week ended October 21 in the former and November 11 in the latter. In Iowa a relatively large number of cases continued to be reported through December 1939, and January 1940.

The early appearance of large numbers of cases in South Carolina was not unusual in that section of the country, for in 1935 cases likewise were reported in fairly large numbers from North Carolina as early as April and May. In Michigan the 1939 outbreak appeared several weeks earlier than in the 1931 or 1935 epidemics. However, in Kentucky the disease occurred several weeks later than in 1935. Thus during 1939 poliomyelitis cases were occurring in relatively large numbers in one locality after another over a period of 9 months, i. e., from April to December, inclusive.

There was a marked variation in age distribution of poliomyelitis cases in different localities where epidemics occurred in 1939. For instance, in Charleston County, S. C., 68 percent of the cases were under 5 years of age (13 percent under 1 year) while in Genesee County, N. Y., only 14 percent were under 5 years (1.5 percent under 1 year). In Detroit and Buffalo approximately 30 percent were under 5 years of age. The proportion of cases in the older age groups showed similar variations. In Charleston County 22 percent of the cases were 5 to 9 years of age, 5 percent were in the 10- to 14-year group and 4 percent were 15 years of age and over. In Genesee County, 25, 29, and 30 percent of cases were in the corresponding age groups, while in Buffalo the percentages were 41, 19, and 11, respectively.

In Charleston County a much higher proportion of the cases among colored persons were under 1 year and 1 to 4 years of age than among white persons. The youngest case reported was a month-old colored infant which had a definite paralysis of the left leg. However, the high proportion of cases in the younger age groups in Charleston County in 1939 was not materially different from the distribution of cases reported in North Carolina in 1935.

Data from a few areas, Charleston County, Buffalo, and Minnesota, indicate that case fatality rates were comparatively low in 1939, at least in the localities mentioned. The fatality rates varied between 2.5 and 9 percent in these areas.

Comparatively few States in their reports segregate paralytic from nonparalytic and abortive cases of poliomyelitis. The segregation as to types is important for two reasons. First, a much better comparison of incidence by States or counties could be made by comparing numbers of paralytic cases in one area with those in another area,

and similarly with nonparalytic cases. For instance, in 1939, 68 percent of cases reported in Minnesota were paralytic and in Charleston County, S. C., 78 percent were paralytic cases. Another reason for segregation of cases as to type is becoming increasingly apparent to some public health officials and other investigators with the proof of the existence of other neurotropic virus diseases in many localities. The seasonal occurrence of the St. Louis type of encephalitis and equine encephalomyelitis infections in man is almost identical with that of poliomyelitis, and mild cases of the former may easily be diagnosed incorrectly when these diseases occur sporadically. The possibility of the existence of these newly recognized forms of neurotropic virus infections must also be borne in mind when making a diagnosis of the abortive form of poliomyelitis.

During 1939 the results of several investigations on poliomyelitis were published, the most important of these studies being that of Armstrong (*3*, *4*). He was able to infect the eastern cotton rat, *Sigmodon hispidus hispidus*, with a strain of poliomyelitis virus obtained from the brain of a fatal case which occurred in Lansing, Mich., in 1937. Successful transmission was obtained by intracerebral inoculation after a fourth monkey passage of the virus. Not only has Armstrong been able to maintain this virus through more than 50 passages in the cotton rat, but he also has been able to infect white and house mice with the same strain. Unlike the monkey, in which the infection can be produced by nasal instillation of virus, the cotton rat and mice have been refractory to infection except by intracerebral inoculation of the Lansing strain. The importance of Armstrong's discovery lies in the fact that laboratory studies on poliomyelitis on a much larger scale will be made possible at a much lower cost than has been possible when monkeys were the only animals available for experimental purposes.

During the epidemic of poliomyelitis in Charleston, S. C., Paul, Trask, and Culotta (*5*) obtained samples of sewage from an area in which the hospital used for isolating poliomyelitis cases was located, and they were able to recover the virus from these specimens. Kramer, Gilliam, and Molner (*6*) reported the recovery of the virus from the stools of 3 out of 12 healthy contacts of poliomyelitis cases occurring in an institution in Detroit, and also from the stools of 2 out of 3 children who were classified as abortive cases. Silverman (*7*), in a personal communication, stated that the presence of the virus was demonstrated in the stools of 3 cases of poliomyelitis in an institutional outbreak in Syracuse, where a total of 6 cases was reported in March and April of 1939.

Although previous studies have demonstrated the presence of poliomyelitis virus in the stools of patients, particularly mild and abortive cases, these recent reports seem to indicate a much wider

distribution of the virus than heretofore suspected. However, there have been no studies made in which the virus was recovered from the stools of apparently healthy persons living in a community where the disease is either absent or occurring sporadically. These reports on the recovery of the virus from the stools of mild cases and contacts, and from sewage obtained from an epidemic area, have not thrown any new light on one of the unsolved problems in the epidemiology of the disease, namely, the mode of transmission. Although experimental evidence has, according to several investigators (*8*, *9*, *10*), tended to question the validity of the most commonly accepted belief that the virus gains entrance into the human body through the nasal passages, none of the recent studies has been inconsistent with the theory of transmission of infection by direct contact with cases and carriers.

The morbidity data on poliomyelitis by counties used in the preparation of the map accompanying this report were taken from the files of the Division of Sanitary Reports and Statistics of the Public Health Service. Special thanks are due Mr. H. G. Eubank and his staff for making these data available. Acknowledgment is also made to Dr. E. L. Stebbins, New York State Department of Health, Dr. O. McDaniel, Minnesota Department of Health, and Dr. F. E. Fronczak, Health Commissioner of Buffalo, for supplying information for this report. Dr. A. G. Gilliam, National Institute of Health, permitted the use of certain data from his files for Charleston County, S. C.

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THE COURSE OF DISABLING MORBIDITY AMONG INDUSTRIAL WORKERS, 1921–38 [1]

By William M. Gafafer, Senior Statistician, United States Public Health Service

During the past few years industry has become increasingly interested in the keeping of records of absenteeism, realizing more and more that it is necessary to know something of the magnitude and nature of the problem of illness in industry before any measurable progress can be made in the protection and improvement of the health of the working population. It is, therefore, particularly appropriate to present an historical paper based on industrial morbidity records.

It is appropriate also to recall the remarks published almost a quarter of a century ago by a committee under the chairmanship of Sir George Newman. In referring to indications of sickness the committee wrote, "Every case of lost time or absence calls for inquiry. It should be properly recorded. A study of such records is certain to disclose the existence of adverse influences or circumstances, today unsuspected, which may denote the beginning of sickness" (*1*).

For many years the Division of Industrial Hygiene of the National Institute of Health has stimulated the keeping of records through appropriate committee memberships, contacts with those interested, and pertinent publications. Of the various publications on industrial absenteeism from the Division, reference is made to the quarterly contributions to the Public Health Reports on disabling morbidity among industrial workers, since the present paper and the quarterly reports are based upon data from the same source.

The quarterly reports on disabling morbidity have appeared for approximately 20 years and are based on the reported experience of the memberships of industrial sick benefit organizations comprising mutual sick benefit associations, group insurance plans, and company relief departments. It is important to recognize that data of this type have a number of inherent limitations, which have been referred to in some detail in recent studies (*2*, *3*). These limitations, among others, have to do with the exclusion from membership of workers engaged in certain occupations, or because of age, presence of certain chronic diseases, and particular physical defects found at examination at the time of application for membership. While all of the sick benefit organizations do not subscribe to all of the limiting factors referred to, nevertheless the memberships may be considered, to some extent, selected groups.

In connection with factors probably imposing limitations upon the data it should be mentioned that the time period selected for study,

[1] From the Division of Industrial Hygiene, National Institute of Health

Read before the Annual General Motors Medical Conference, November 2, 1939, at Dayton, Ohio. This paper appeared with some minor changes in Industrial Medicine, February 1940

namely, the years 1921 through 1938, was unique in that it contained an economic depression characterized chiefly by unemployment of extraordinary magnitude. Briefly, this unemployment was reflected in the memberships of the sick benefit organizations not only by decreases in size but also probably by changes in relative constitution with respect to certain factors.

With regard to the geographic location of the industries, none was situated in the South or in the far West.

With the recognition of the type of data available it is purposed in the present paper to show the course of disabling morbidity during the period 1921–38 as determined by reported cases of sickness and nonindustrial injuries among the memberships of various industrial sick benefit organizations. In particular, the time changes in morbidity will be measured in terms of the average annual frequency of cases causing disability for 8 consecutive calendar days or longer and attention will be directed, among other things, to sex differences

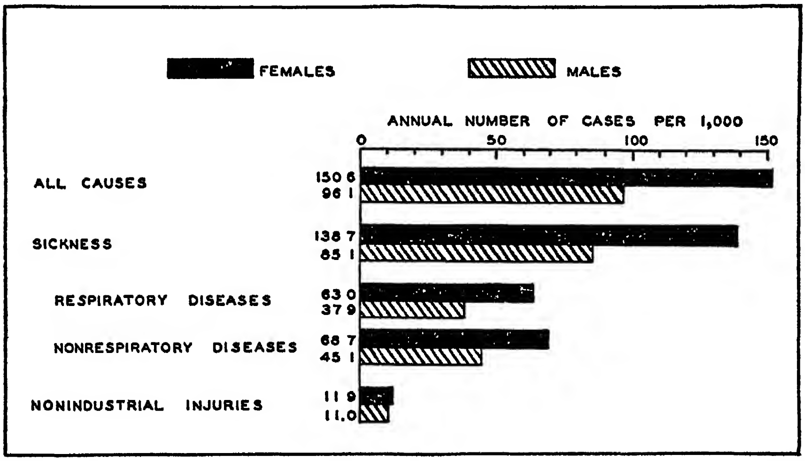

FIGURE 1.—Annual number of cases per 1,000 workers causing disability lasting 8 calendar days or longer, according to broad cause groups, males and females compared, 1921–38, inclusive

specific for broad cause groups, and differences among industrial groups with respect to cause.

ANALYSIS OF THE DATA

The available data for the 18 years represent 2,652,759 years of exposure for males and 238,240 years for females. The male exposure may be classified according to industrial groups, as follows: Iron and steel, 1,144,326 years (43 percent), public utilities, 560,638 years (21 percent), and miscellaneous, 947,795 years (36 percent), the last comprising industries making chemicals, plumbing fixtures, electrical equipment, paper, paper novelties, timepieces, hats, underwear, flour,

soap, and certain other products. For statistical purposes the 18 years have been grouped into the 6 triennia.

Sex differences by broad cause groups, 1921–38.—Among other things table 1 shows for males and females the annual number of cases per 1,000 employees according to broad cause groups. Thus the annual rate for all causes with respect to cases that began during 1921–38 among females is 150.6, while the corresponding rate for males is 96.1. These rates and the corresponding ones for broad cause groups are presented graphically in figure 1. It will be observed that, with the exception of the rates for nonindustrial injuries which show only a slight sex difference favoring the males, all of the rates for the females are definitely greater than the corresponding ones for the males, the percentage excess in each instance being more than 50 percent.

TABLE 1.—*Frequency of sickness and nonindustrial injuries causing disability lasting 8 consecutive calendar days or longer by broad cause groups according to triennium in which cases began,* MALE *and* FEMALE *employees in various industries, 1921–38, inclusive*

Triennium in which cases began	Sickness and nonindustrial injuries [1]	Nonindustrial injuries	Sickness [1]	Respiratory diseases	Nonrespiratory diseases	Ill-defined and unknown causes	Total person-years of membership
	Annual number of cases per 1,000 males						
1921–38	96.1	11.0	85.1	37.9	45.1	2.1	2,652,759
1921–23	94.1	8.3	85.8	40.8	42.7	2.3	222,460
1924–26	104.6	10.6	94.0	44.2	47.5	2.3	347,582
1927–29	109.8	11.6	98.2	46.2	50.3	1.7	523,473
1930–32	95.4	12.4	83.0	34.8	46.2	2.0	524,387
1933–35	81.8	11.6	70.2	27.5	40.9	1.8	484,805
1936–38	90.8	11.5	79.3	33.6	43.1	2.6	550,052
	Annual number of cases per 1,000 females						
1921–38	150.6	11.9	138.7	63.0	68.7	7.0	238,240
1921–23	139.5	8.0	131.5	63.7	53.8	14.0	21,047
1924–26	159.4	10.9	148.5	67.6	71.6	9.3	47,704
1927–29	167.3	12.8	154.5	75.5	73.6	5.4	37,530
1930–32	155.2	13.9	141.3	61.8	74.8	4.7	39,374
1933–35	139.9	12.8	127.1	51.5	71.7	3.9	45,280
1936–38	142.1	12.6	129.5	58.0	67.0	4.5	47,305
	Ratio of female rate to male rate						
1921–38	1.57	1.08	1.63	1.66	1.52	3.33	
1921–23	1.48	.96	1.53	1.56	1.26	6.09	
1924–26	1.52	1.03	1.58	1.53	1.51	4.04	
1927–29	1.52	1.10	1.57	1.63	1.46	3.18	
1930–32	1.63	1.12	1.70	1.78	1.62	2.35	
1933–35	1.71	1.10	1.81	1.87	1.75	2.17	
1936–38	1.56	1.10	1.63	1.73	1.55	1.73	

[1] Industrial injuries and venereal diseases are not included.

Sex differences by broad cause groups and triennia.—The observation that the frequency rates covering the entire time period were greater

among the females than among the males raises the question of how the rates behaved during the time period, for example, by triennia. Table 1 presents these data and figure 2 shows them graphically. It will be seen that again with the exception of nonindustrial injuries the frequencies for the females are definitely greater than those for

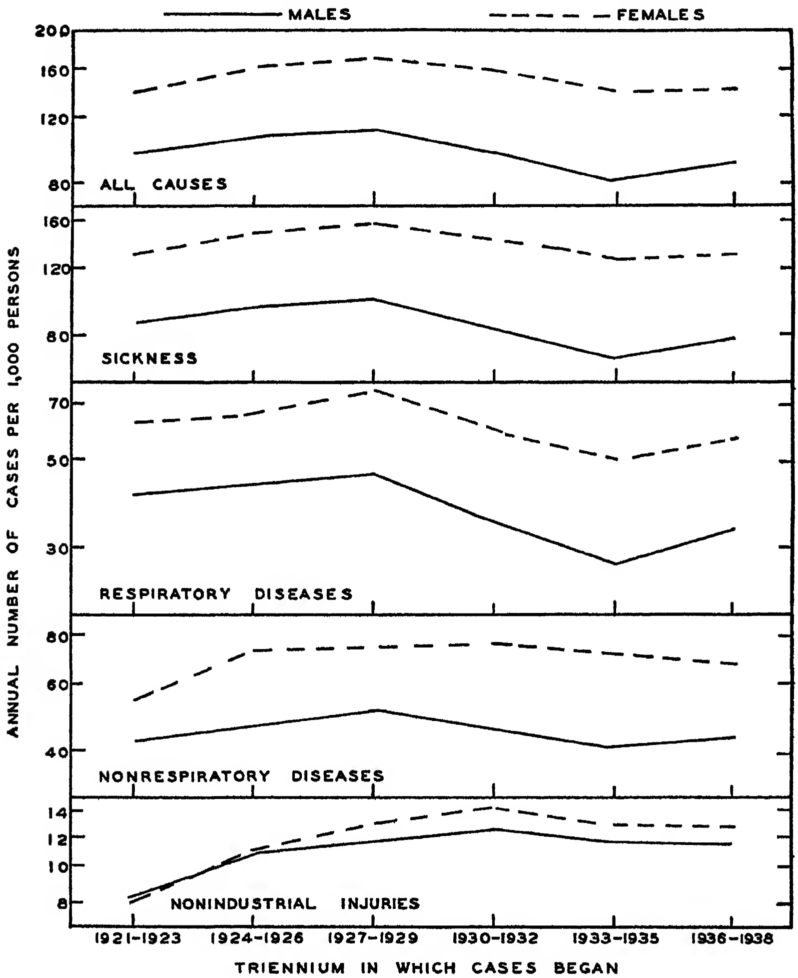

FIGURE 2.—Annual number of cases per 1,000 workers causing disability lasting 8 calendar days or longer, according to broad cause groups, by triennium in which cases began, males and females compared, 1921-38, inclusive. (Vertical logarithmic scale.)

the males, the lowest of all the triennial rates for any cause group among the females being greater than the highest triennial rate shown by the corresponding cause group among the males.

Of interest is the minimum shown by the triennial respiratory rate for 1933–35 among both sexes. It will be noted that the size of the

rate is sufficiently small to be reflected in the curves for all sickness as well as for all causes. Of considerable interest also are the trends of the frequencies. When straight trend lines are fitted by hand to the various curves representing the cause groups it will be observed that for all causes the trends for both sexes decrease slightly. With respect to the nonrespiratory group the males show a slight downward trend while the trend for the female workers appears to increase slightly. The lines representing the movement of all sickness, that is, all causes without nonindustrial injuries, show a downward trend which is more in evidence among the males, the principal determining factor of movement being the respiratory group with its downward trend for the females and the pronounced downward trend for the males. The

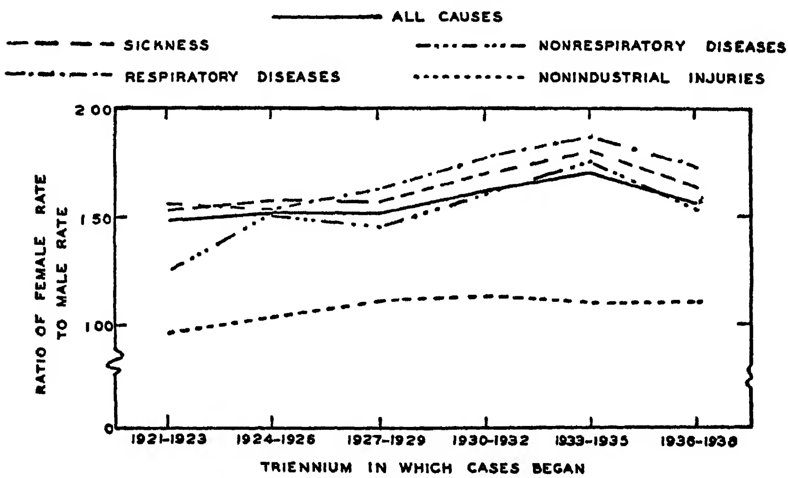

FIGURE 3.—Ratio of female rate to male rate, according to broad cause groups, by triennium in which cases began, 1921–38, inclusive ("Rate" refers to the annual number of cases per 1,000 workers causing disability lasting 8 calendar days or longer.)

group, nonindustrial injuries, on the other hand, shows an upward trend among females as well as males, corresponding triennial frequencies showing only small sex differences.

Sex ratios of frequencies by broad cause groups and triennia.—Attention has been directed to the behavior of the frequencies by cause groups for each sex, and reference was made to the generally higher rates for the females. Sex differences may be further examined with the use of the ratio of the female frequency to that of the corresponding male frequency which ratio thus shows the variation of the female frequency in terms of that for the males. Such ratios are shown in table 1, and their time changes may be seen graphically in figure 3. Most striking is the peak corresponding to the triennium 1933–35, shown by all of the curves except that for nonindustrial injuries. This triennium, as indicated in the last section, showed minimum

rates among males and females for the respiratory group of causes, which minima were reflected in the curves for all sickness as well as for all causes. Thus while the respective frequencies for males and females were at a minimum, the frequency for females was sufficiently greater than the corresponding one for males to produce a maximum ratio.

The following will also be observed: First, with the exception of the ratio, 0.96, for nonindustrial injuries corresponding to the first triennium, all ratios are greater than 1. Second, the curves representing the ratios corresponding to the 3 cause groups (respiratory diseases, nonrespiratory diseases, and nonindustrial injuries) are distinct in that they do not cross each other; for a particular triennium the respiratory ratio is largest, followed by the nonrespiratory ratio, and then by that of the nonindustrial injuries. And, third, the trends of the ratios for the 3 cause groups rise, those representing the respiratory and nonrespiratory causes almost at the same rate while the nonindustrial injury trend rises more slowly. The 18 years' experience thus shows that not only were the frequencies for the females greater than those for the males with respect to the respiratory and nonrespiratory diseases and nonindustrial injuries (first triennium excepted), but relative differences between corresponding frequencies showed a perceptible rise. This observation is of considerable interest, and particularly so in the instance of the respiratory group when it is recalled that the male and female trends for this group of causes showed a sensible decline.

Frequencies among males by specific causes and triennia.—The available data for males but not for females are sufficiently extensive to permit the examination of frequencies by cause. Rates for specific causes only will be examined since the previous sections deal with the broad cause groups. Table 2 gives the requisite rates, and a close inspection of their fluctuation from triennium to triennium reveals a number of causes with upward or downward trends, some more pronounced than others.

Causes showing downward trends are bronchitis, diseases of the pharynx and tonsils, pneumonia, respiratory tuberculosis, diseases of the stomach, diarrhea and enteritis, the rheumatic group,[2] neurasthenia, nephritis, diseases of the skin, and cancer.

Those causes showing an upward trend are appendicitis, and diseases of the circulatory system.

Causes apparently showing a reasonably level trend are influenza and grippe, hernia, and infectious and parasitic diseases.

The minimum morbidity, which occurred in 1933–35, is shown by bronchitis, diseases of the pharynx and tonsils, influenza and grippe,

[2] The rheumatic group includes Rheumatism, acute and chronic, neuralgia, neuritis, and sciatica, and diseases of the organs of locomotion except diseases of the joints

TABLE 2.—*Frequency of sickness and nonindustrial injuries causing disability lasting 8 consecutive calendar days or longer by triennium in which cases began according to cause,* MALE *employees in various industries, 1921–38, inclusive*

Cause (Numbers in parentheses are disease title numbers from the International List of the Causes of Death, 1929)	Triennium in which cases began						Average, all triennia
	1921–1923	1924–1926	1927–1929	1930–1932	1933–1935	1936–1938	
Sickness and nonindustrial injuries [1]	94.1	104.6	109.8	95.4	81.8	90.8	96.1
Nonindustrial injuries	8.3	10.6	11.6	12.4	11.6	11.5	11.0
Sickness	85.8	94.0	98.2	83.0	70.2	79.3	85.1
Respiratory diseases	40.8	44.2	46.2	34.8	27.5	33.6	37.9
Bronchitis, acute and chronic (106)	5.5	5.8	5.7	3.9	3.3	4.6	4.8
Diseases of the pharynx and tonsils (115a)	5.6	6.8	6.5	5.2	4.4	4.9	5.6
Influenza and grippe (11)	18.8	21.8	24.2	18.1	12.7	15.5	18.5
Pneumonia, all forms (107–109)	3.4	3.2	3.3	2.2	2.0	2.6	2.8
Tuberculosis of the respiratory system (23)	1.7	1.4	1.3	1.0	.9	.8	1.2
Other respiratory diseases (104, 105, 110–114)	5.8	5.2	5.2	4.4	4.2	5.2	5.0
Digestive diseases	12.5	14.2	15.1	13.9	12.5	13.6	13.6
Diseases of the stomach, except cancer (117, 118)	4.1	5.0	4.8	4.3	3.4	4.0	4.2
Diarrhea and enteritis (120)	1.9	1.7	1.4	1.2	1.1	1.2	1.4
Appendicitis (121)	3.0	3.6	4.4	3.7	3.7	4.1	3.8
Hernia (122a)	1.6	1.4	1.7	1.8	1.4	1.6	1.6
Other digestive diseases (115b, 116, 122b–129)	1.9	2.5	2.8	2.9	2.9	2.7	2.6
Nonrespiratory-nondigestive diseases	30.2	33.3	35.2	32.3	28.4	29.5	31.5
Infectious and parasitic diseases (1–10, 12–22, 24–33, 36–44)	2.4	3.1	3.4	3.3	2.5	2.3	2.8
Rheumatism, acute and chronic (56, 57)	5.0	6.2	6.1	5.4	4.3	4.0	5.2
Neuralgia, neuritis, sciatica (87a)	1.8	2.1	2.3	2.2	2.1	2.2	2.1
Neurasthenia and the like (part of 87b)	1.7	1.7	1.4	1.3	.9	1.1	1.4
Other diseases of the nervous system (78–85, part of 87b)	.5	.8	1.0	1.1	1.4	1.1	1.0
Diseases of the heart (90–95)	1.3	1.7	2.1	2.2	2.2	2.5	2.0
Other diseases of the circulatory system (96–103)	2.3	2.4	2.9	3.0	2.7	3.1	2.7
Nephritis, acute and chronic (130–132)	.8	.7	.8	.7	.5	.5	.7
Other diseases of the genitourinary system (133–139)	1.7	2.0	2.2	2.3	2.4	2.3	2.2
Diseases of the skin (151–153)	3.5	3.6	4.4	3.2	2.6	3.0	3.4
Diseases of the organs of locomotion except diseases of the joints (156b)	3.0	3.4	3.8	3.4	2.7	2.9	3.2
Cancer, all sites (45–53)	.6	.7	.5	.6	.5	.5	.5
All other diseases (54, 55, 58–77, 88, 89, 140–150, 154–156a, 157, 162)	5.6	4.9	4.3	3.6	3.6	4.0	4.3
Ill-defined and unknown causes (200)	2.3	2.3	1.7	2.0	1.8	2.6	2.1
Number of person-years of membership	222,460	347,582	523,473	524,387	484,805	550,052	2,652,759

[1] Industrial injuries and venereal diseases are not included.

pneumonia, diseases of the stomach, hernia, neurasthenia, and diseases of the skin.

Frequencies among males according to broad cause groups and certain selected causes by industrial group and triennium.—Thus far the data have been examined without reference to specific industries. The question arises of how closely the frequencies for specific industries follow the trend for all industries combined. The magnitude of the available data makes it possible to classify the cooperating industries into three broad groups, namely, iron and steel, representing 43 per-

cent of the total male membership, public utilities, representing 21 percent, and miscellaneous industries, representing 36 percent. For each industrial group the time changes in the frequencies will be examined for the broad sickness groups and for certain selected causes,

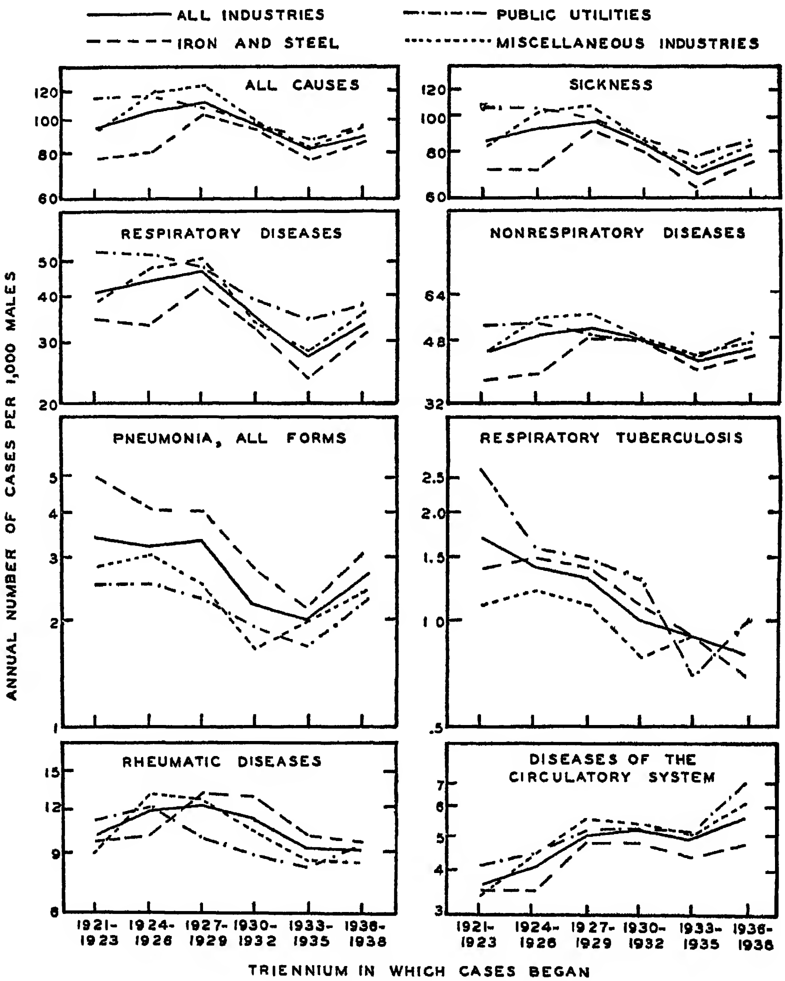

FIGURE 4.—Annual number of cases per 1,000 males causing disability lasting 8 calendar days or longer, according to broad cause groups and certain selected causes, by industrial group and triennium in which cases began, 1921–38, inclusive. (Vertical logarithmic scale.) Note that in the instance of respiratory tuberculosis the points for "all industries" and "miscellaneous industries" coincide in the triennia 1933–35 and 1936–38.

including pneumonia, respiratory tuberculosis, rheumatic diseases, and diseases of the circulatory system (including diseases of the heart). Table 3 presents the pertinent data and figure 4 shows them graphically.

TABLE 3.—*Frequency of sickness and nonindustrial injuries, classified according to broad cause groups and certain selected causes, causing disability lasting 8 consecutive calendar days or longer by triennium in which cases began according to industry,* MALE *employees, 1921–38, inclusive*

Industry	Annual number of cases per 1,000							Ratio to rate for 1921–1938					
	1921–1938	1921–1923	1924–1926	1927–1929	1930–1932	1933–1935	1936–1938	1921–1923	1924–1926	1927–1929	1930–1932	1933–1935	1936–1938
	Sickness and nonindustrial injuries												
All industries	96.1	94.1	104.6	109.8	95.4	81.8	90.8	0.98	1.09	1.14	0.99	0.85	0.94
Iron and steel	89.8	78.2	80.9	104.8	94.3	77.2	87.7	.87	.90	1.17	1.05	.86	.98
Public utilities	102.3	114.7	115.2	107.9	96.1	88.3	95.7	1.12	1.13	1.05	.94	.86	.94
Miscellaneous industries	99.8	93.5	116.6	120.5	96.1	83.3	93.8	.94	1.17	1.21	.96	.83	.94
	Sickness												
All industries	85.1	85.8	94.0	98.2	83.0	70.2	79.3	1.01	1.10	1.15	0.98	0.82	0.93
Iron and steel	78.0	71.8	72.5	93.1	80.9	64.7	74.9	.92	.93	1.19	1.04	.83	.96
Public utilities	93.0	106.6	106.2	98.4	86.5	78.3	86.7	1.15	1.14	1.06	.93	.84	.93
Miscellaneous industries	87.7	83.1	103.5	107.4	83.0	71.9	83.0	.95	1.18	1.22	.95	.82	.95
	Respiratory diseases												
All industries	37.9	40.8	44.2	46.2	34.8	27.5	33.6	1.08	1.17	1.22	0.92	0.73	0.89
Iron and steel	33.4	34.5	33.5	43.0	32.9	23.7	31.3	1.03	1.00	1.29	.99	.71	.94
Public utilities	43.4	53.3	51.9	47.8	39.1	34.4	37.2	1.23	1.20	1.10	.90	.79	.86
Miscellaneous industries	38.3	38.0	48.0	51.0	34.1	28.0	35.9	.99	1.25	1.33	.89	.73	.94
	Nonrespiratory diseases [1]												
All industries	47.2	45.0	49.8	52.0	48.2	42.7	45.7	0.95	1.06	1.10	1.02	0.90	0.97
Iron and steel	44.6	37.3	39.0	50.1	48.0	41.0	43.6	.84	.87	1.12	1.08	.92	.98
Public utilities	49.6	53.3	54.3	50.6	47.4	43.9	49.5	1.07	1.09	1.02	.96	.89	1.00
Miscellaneous industries	49.4	45.1	55.5	56.4	48.9	43.9	47.1	.91	1.12	1.14	.99	.89	.95
	Pneumonia, all forms												
All industries	2.8	3.4	3.2	3.3	2.2	2.0	2.6	1.21	1.14	1.18	0.79	0.71	0.93
Iron and steel	3.3	5.0	4.1	4.0	2.8	2.2	3.0	1.52	1.24	1.21	.85	.67	.91
Public utilities	2.2	2.5	2.5	2.3	1.9	1.7	2.2	1.14	1.14	1.05	.86	.77	1.00
Miscellaneous industries	2.3	2.8	3.0	2.5	1.7	2.0	2.4	1.22	1.30	1.09	.74	.87	1.04
	Tuberculosis of the respiratory system												
All industries	1.2	1.7	1.4	1.3	1.0	0.9	0.8	1.42	1.17	1.08	0.83	0.75	0.67
Iron and steel	1.1	1.4	1.5	1.4	1.1	.9	.7	1.27	1.36	1.27	1.00	.82	.64
Public utilities	1.4	2.6	1.6	1.5	1.3	.7	1.0	1.86	1.14	1.07	.93	.50	.71
Miscellaneous industries	1.0	1.1	1.2	1.1	.8	.9	.8	1.10	1.20	1.10	.80	.90	.80

[1] Includes a small number of cases of ill-defined and unknown diagnosis.

TABLE 3.—*Frequency of sickness and nonindustrial injuries, classified according to broad cause groups and certain selected causes, causing disability lasting 8 consecutive calendar days or longer by triennium in which cases began according to industry,* MALE *employees, 1921–38, inclusive*—Continued

Industry	Annual number of cases per 1,000							Ratio to rate for 1921–1938					
	1921–1938	1921–1923	1924–1926	1927–1929	1930–1932	1933–1935	1936–1938	1921–1923	1924–1926	1927–1929	1930–1932	1933–1935	1936–1938
	Rheumatic diseases [2]												
All industries	10.5	9.8	11.7	12.2	11.0	9.1	9.1	0.93	1.11	1.16	1.05	0.87	0.87
Iron and steel	11.1	9.5	10.0	13.0	12.7	10.0	9.6	.86	.90	1.17	1.14	.90	.86
Public utilities	9.8	11.0	12.0	9.9	8.9	8.2	9.3	1.12	1.22	1.01	.91	.84	.95
Miscellaneous industries	10.2	9.1	13.0	12.5	10.3	8.5	8.4	.89	1.27	1.23	1.01	.83	.82
	Diseases of the circulatory system (including diseases of the heart)												
All industries	4.7	3.6	4.1	5.0	5.2	4.9	5.6	0.77	0.87	1.06	1.11	1.04	1.19
Iron and steel	4.5	3.5	3.5	4.7	4.8	4.4	4.7	.78	.78	1.04	1.07	.98	1.04
Public utilities	5.3	4.1	4.5	5.2	5.2	5.1	6.9	.77	.85	.98	.98	.96	1.30
Miscellaneous industries	5.2	3.4	4.4	5.5	5.4	5.1	6.2	.65	.85	1.06	1.04	.98	1.19
	Number of person-years of membership												
All industries	2,652,759	222,460	347,582	523,473	524,387	484,805	550,052	----	----	----	----	----	----
Iron and steel	1,144,326	76,066	111,888	262,752	226,172	200,691	266,757	----	----	----	----	----	----
Public utilities	560,638	62,505	89,637	111,105	116,935	86,357	94,099	----	----	----	----	----	----
Miscellaneous industries	947,795	83,889	146,057	149,616	181,280	197,757	189,196	----	----	----	----	----	----

[2] Rheumatism, acute and chronic, diseases of the organs of locomotion except diseases of the joints, neuralgia, neuritis and sciatica.

An inspection of figure 4 reveals that the trends, while not precisely the same, are downward for the three industrial groups in respect of all sickness, respiratory diseases, pneumonia, and respiratory tuberculosis, and upward for diseases of the circulatory system. In the remaining three instances the trends among the industrial groups differ from the corresponding trends for the combined industries. In each of these three instances iron and steel appears to be the responsible factor; thus, in respect of all causes, the rheumatic diseases, and the nonrespiratory diseases, respectively, where the trends are generally downward, iron and steel shows a level trend in the first two instances and an upward one in the last instance.

In connection with the trend in the iron and steel industry attention should be directed to its isolated position in the graphical presentation of all causes, all sickness, respiratory diseases, and pneumonia, respectively; in the first three instances the iron and steel curve is the lowest of all curves, while for pneumonia the curve lies definitely above all others. Attention is also directed particularly to the position of

iron and steel with reference to the nonrespiratory diseases and diseases of the circulatory system.

Ratio of triennial frequencies to frequency for 1921–38 according to industrial groups by broad cause group and certain selected causes.—The behavior of the absolute frequencies yielded by the industrial groups was examined in the preceding section and the findings are believed sufficiently striking to demand further inspection. Among others, questions may be raised concerning the magnitude of the excesses or defects in the triennial frequencies with respect to a "normal" frequency rate.

A reasonable normal frequency for a particular industrial group and cause may be defined as the average annual frequency yielded by that industrial group and cause, and based on the entire experience of 18 years. Thus the average annual number of cases of pneumonia per 1,000 iron and steel workers for the period 1921–38 was 3.3, and this is the defined normal frequency for pneumonia among iron and steel workers. The determination of the pneumonia excess or defect for a particular triennium follows by obtaining the ratio of the triennial frequency to the normal frequency. For example, table 3 shows, among other things, the pneumonia rate for 1921–38 among iron and steel workers to be 3.3; the corresponding rate for 1921–23 was 5.0. The ratio for 1921–23, therefore, is 5.0 to 3.3 or 1.52, which means that the triennial pneumonia rate for 1921–23 was 52 percent in excess of the normal pneumonia rate among iron and steel workers. The whole procedure may be summed up by stating that the different triennial rates are expressed in terms of corresponding average rates determined by the entire experience of 18 years.

Before examining the magnitudes of the specific ratios it is illuminating to observe the normal rates upon which the ratios are based. These normal rates are shown in the first column of table 3.[3] It will be observed that each cause group and cause, with the exception of the nonrespiratory diseases, presents great variation in the size of the normal values. Thus while iron and steel shows relatively low normals with respect to all causes, all sickness, respiratory diseases, respiratory tuberculosis, and diseases of the circulatory system, respectively, the normals for the same industrial group are relatively high with respect to pneumonia and the rheumatic diseases.

Having referred briefly to the magnitude of the values defined as normal it is now logical to examine the excesses and defects as determined by the ratios. The ratios are presented in table 3 and a particular percentage in excess or defect may be determined at sight. Figure 5 shows graphically the behavior of the ratios with time. Interest centers round the area, for each cause group and cause, in

[3] Some of these values are shown graphically in figure 1, the difference in the instance of the nonrespiratory diseases being accounted for by the ill-defined and unknown causes.

which the ratios operate,[4] particularly the size of the zone determined by the upper and lower limits of the ratios (regardless of industrial group) and the degree of concentration presented by the

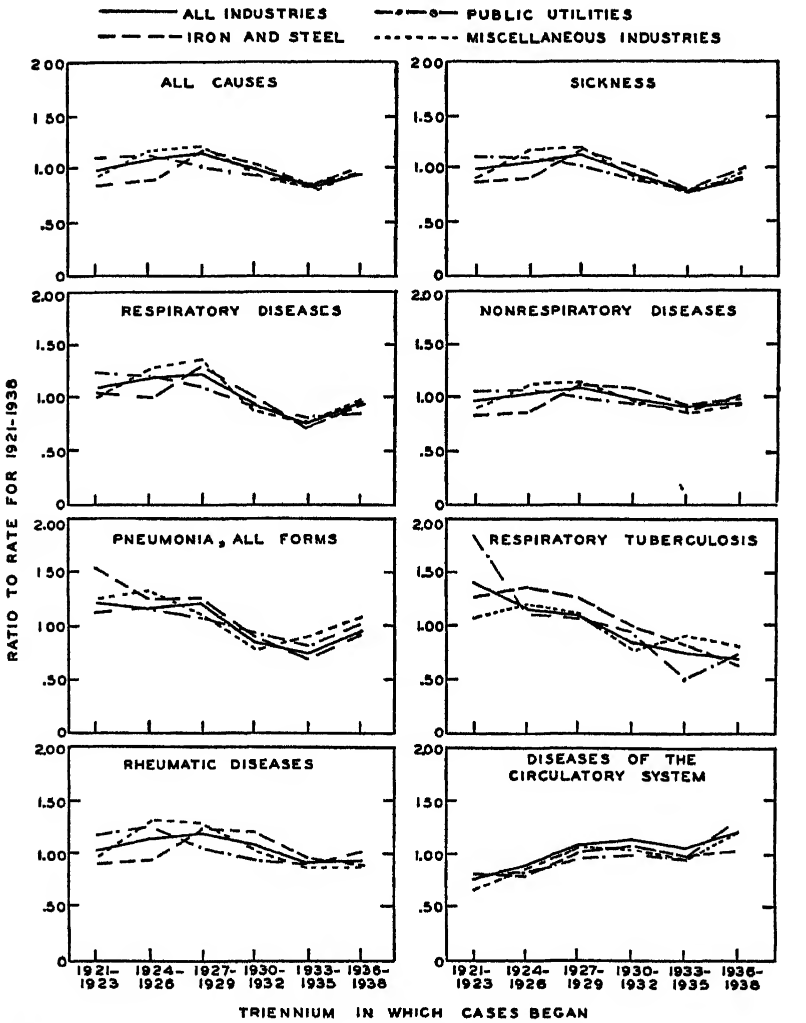

FIGURE 5.—Ratio of rates for each triennium to rate for 1921-38, inclusive, according to broad cause groups and certain selected causes, by industrial group, 1921-38, inclusive ("Rate" refers to the annual number of cases per 1,000 males causing disability lasting 8 calendar days or longer.)

pattern comprising the individual curves. Thus the largest zone of activity is presented by respiratory tuberculosis, moving as it does from an excess of 86 percent to a defect of 50 percent, both percent-

[4] The trends of the ratios may be shown graphically by plotting on semilogarithmic graph paper; this has not been done since these trends would be precisely the same as those shown by the absolute frequencies in figure 4.

ages, as it happens, being from the public utilities. The most concentrated pattern is presented by diseases of the circulatory system, indicating similarity of activity among the different industrial groups.

SUMMARY

This paper, dealing with the time changes (1921–38) in the frequency of sickness and nonindustrial injuries causing disability lasting more than 1 week, is based on the reported experience of the memberships of industrial sick benefit organizations. The results may be briefly summarized as follows:

1. All sickness shows a downward trend which is more in evidence among males than among females, the principal determining factor of movement being the respiratory diseases.

2. Nonindustrial injuries show an upward trend among females as well as males.

3. The trends of the female-to-male ratio rise, those representing the respiratory and nonrespiratory groups almost at the same rate while the nonindustrial injury trend rises more slowly.

4. Among males, diseases of the circulatory system, including diseases of the heart, and appendicitis show an upward trend.

5. While not precisely the same, the trends among males are downward for the three industrial groups, iron and steel, public utilities, and miscellaneous industries, in respect of all sickness, respiratory diseases, pneumonia, and respiratory tuberculosis, and upward for diseases of the circulatory system including diseases of the heart.

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STUDIES OF SEWAGE PURIFICATION

XIII. THE BIOLOGY OF *SPHAEROTILUS NATANS* KUTZING IN RELATION TO BULKING OF ACTIVATED SLUDGE

By JAMES B. LACKEY, *Cytologist*, and ELSIE WATTIE, *Assistant Bacteriologist, United States Public Health Service, Stream Pollution Investigations Station, Cincinnati, Ohio*

INTRODUCTION

The term bulking, as applied to sewage disposal plants, is usually definable only in terms of its user. It may mean rising of the sludge blanket until the sludge passes the weir or it may mean great increase in sludge volume accomplished by loss of density. In any case, it means that the operator has lost control of the sludge. Its causes likewise vary according to the type of bulking, whether we are dealing with a given mass of sludge occupying several times the volume it normally should, whether there is flotation of the floc by gas bubbles, or by filamentous organisms, or other causes. In one sense, the end result is the same. The effluent is no longer clear but contains objectionable putrescible matter.

Sewage usually contains a variety of filamentous growths ranging from bacteria, which develop in masses because of confluent gelatinous sheathlike secretions, to ramifying branched mycelia of the true molds. A number of these filamentous organisms have been isolated from sewage and one, *Sphaerotilus natans* Kutzing, has long been associated with bulking. Sometimes it is regarded as the cause of bulking and again as merely being associated with it. The first description of the organism recorded it from "factory water" and it is almost invariably found in polluted waters. Butcher (*1*) has shown roughly the conditions of its principal occurrence in nature and no sewage polluted stream seems clear of it. Naumann and Wanselin (*2*) have shown that heavy growths of *Sphaerotilus natans* in polluted streams are accompanied by oxygen depletion, creation of a septic mud, and even obstruction of stream flow. They consider luxuriant growths a basis for legal action.

Sphaerotilvs is not normally an abundant growth in an activated sludge chamber, although a few filaments may usually be seen on microscopic examination. But a bulking sludge frequently contains enormous quantities of it. Ardern and Lockett, according to Martin (*3*), had connected bulking with filamentous growths prior to 1922. Hoyle (*4*) in 1927 reported *Sphaerotilus natans* as the cause of severe bulking. Morgan and Beck (*5*) reported a similar case in 1928 and Ruchhoft and Watkins (*6*) studied the *Sphaerotilus* from this bulking sludge in pure culture. Larsen (*7*) considers the fungus merely incidental to bulking and McLachlan (*8*) questions causation of bulking by the fungus.

Smit (*9, 10*) investigated a filamentous organism which he called the "causative organism" of bulking, although he was not sure it was *Sphaerotilus*. He called it a facultative anaerobe. Naumann (*11*) showed a huge use of oxygen by *Sphaerotilus* and found a high biochemical oxygen demand for *Sphaerotilus* mud. Ingols and Heukelekian (*12*) state that bulking "produced by carbohydrates is a direct response of *Sphaerotilus* to a relatively long contact with an available energy food." It appears then that *Sphaerotilus* or organisms akin to it have been shown to be intimately associated with sewage pollution and have been repeatedly investigated in connection with the bulking of activated sludge.

ISOLATION AND CULTURE

Because of the association shown above, filamentous growths have been isolated and studies made of these pure cultures at the Stream Pollution Investigations Station, Cincinnati, Ohio. In the course of the work several genera of fungi and fourteen *Sphaerotilus* strains have been obtained in bacteria free culture. *Sphaerotilus* cultures have been obtained from the Station experimental plant, both when bulking and when not bulking, from raw Cincinnati sewage, from a sewage polluted stream in a Cincinnati park, from the Ohio River at Cincinnati, and from bulking sludge obtained at the Lima, Ohio, plant.

One significant point is that, despite diverse origins, all *Sphaerotilus* strains have behaved alike in culture, and all have shown sufficient variability under experimental conditions to enable them to be classified at various times as several of the described species of *Sphaerotilus*. We believe all our strains to be *Sphaerotilus natans* Kutzing, and are of the opinion that the species is capable of considerable variation in a changing environment.

The original isolation was obtained from sludge in which only an occasional strand of fungus was to be found. These strands were placed in 8-liter pyrex bottles containing an enrichment of 1,000 p. p. m. of sucrose, and then aerated in the laboratory. Fed by the fill and draw method twice a day, such bottles usually showed an abundant growth of *Sphaerotilus* in a few days. From this material small flocs consisting largely of fungus were picked, teased, and washed. The usual bacteriological technique was followed, shaking the fungus-laden sludge flocs to pieces with glass beads, diluting, and plating on nutrient agar, from which sterile colonies were subsequently picked. Fungus flocs were also washed 8 to 10 times in sterile dilution water, then streaked on sterile agar plates. Such flocs usually carried bacteria, but around the margin of the colony long sterile filaments grew out in about 24 hours, some of which were cut off and transferred to fresh plates. Agar was first made up according to the formula of Ruchhoft and Watkins (*6*), but subsequently only 1.5

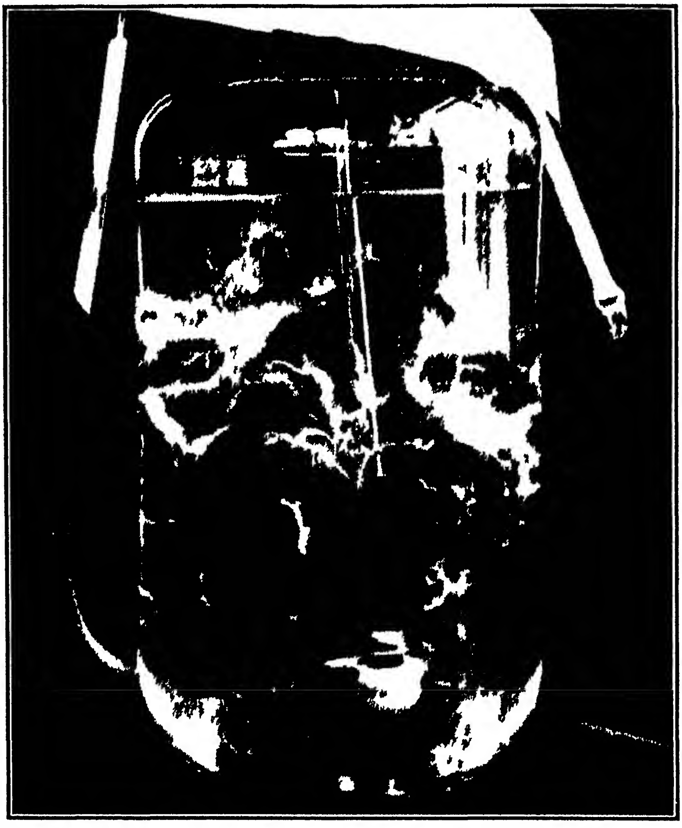

FIGURE 1—Free flocs of *Sphaerotilus* in aeration bottle Air stopped to show the ragged, irregular flocs

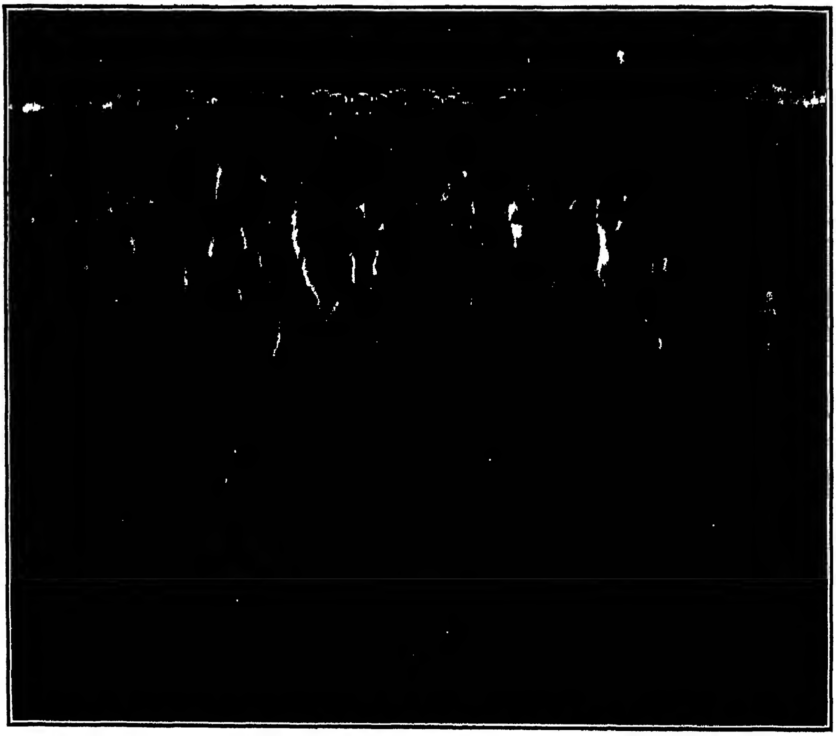

FIGURE 2.—Close-up of side of bottle to show tenuous nature of attached *Sphaerotilus*

percent filtered sewage agar was used. Overgrowth of plates rarely occurred, the maximum growth being secured in about 24 hours at 37° C. or 48 hours at room temperature. Overgrowth of plates frequently occurred when certain bacteria were present, especially at 37° C. A filamentous bacterium tentatively identified as *Bacillus mycoides* was often mistaken for *Sphaerotilus*, but isolations of the bacterium on sewage agar grew about 4 to 8 times as fast as *Sphaerotilus;* the amount of mycelium formed was greater and its strands had a characteristic whorled appearance to the naked eye. In liquid media it did not form flocs.

Growth of *Sphaerotilus* in liquid media was slower than that of the various bacteria used. Sterile filtered sewage plus dextrose, and synthetic sewage plus dextrose were good menstrua. In 12 to 48 hours large flocs were formed. The following are the most successful synthetic media:

L medium	
$NaNO_3$	25 0 mg.
$MgSO_4$	10.0 mg.
K_2HPO_4	10 0 mg.
KH_2PO_4	15.0 mg.
$CaCl_2$	45.0 mg.
Peptone	100.0 mg.
Dextrose	500.0 mg.
Water	1 liter

Synthetic sewage (S medium)	
Na_2HPO_4	50.0 mg.
NaCl	15 0 mg.
KCl	7.0 mg.
$CaCl_2$	7.0 mg.
$MgSO_4$	5.0 mg.
Peptone	100 0 mg.
Dextrose	500 0 mg.
Water	1 liter

Many variations of these two media were used, but no great differences in growth were found unless the concentrations of one or more components were raised or lowered greatly.

These concentrations were made up in 6-liter quantities in pyrex serum bottles and sterilized. The mineral salts used in preparing the basic media were kept in solutions of convenient strengths. After seeding from a plant or liquid medium, the bottles were continuously aerated through a ball diffuser. No attempt was made to determine the rate of aeration. Incoming air passed through a filter of sterilized cotton; the exit tube was also plugged with a cotton filter. Very little trouble was experienced with contamination. Inoculation from a liquid culture was preferable because inoculations from agar plates often failed to show growth in 24 or 48 hours. But cultures on agar plates remain viable as long as 30 days, and on agar slants for even longer periods. Once isolated, *Sphaerotilus* may be easily grown and maintained.

CHARACTERISTICS AND IDENTIFICATION OF THE ORGANISM

According to Bergey (*13*), Kutzing first described the species as "an attached, colorless, thread-like filament, showing false branching." The strands are cylindrical with a thin, firm sheath. The

sheath is slimy and optically invisible but can be demonstrated in India ink mounts or by several staining methods. The cells, cylindrical or ovoid in longitudinal section, vary in diameter from 1 to 3 microns, and in length from 3 to 8 microns, according to age, source (for wild cultures), and culture medium.

The filaments are colorless, but in streams masses of the fungus may be light brown, even with little enmeshed foreign matter. This is probably due to age and dead cells. Single filaments may be several millimeters long, and often many are entwined in a braided manner giving a cordlike appearance. A single strand ends abruptly if free; if attached it ends in a small disc. Flocs are often 1 cm. in diameter and 5 cm. in length if free floating and are very ragged in contour. When attached they are long and plumose. Attachment in

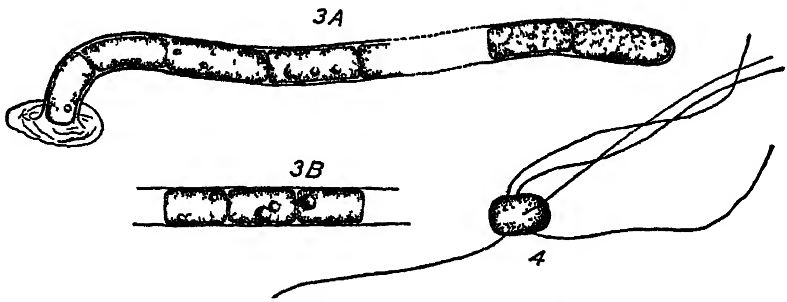

FIGURE 3.—A. Attached strand of *Sphaerotilus*. Note the basal disc and the granular cytoplasm. B. Young cells, shorter than old slower growing cells.
FIGURE 4.—Conidium, motile reproductive cell with irregularly attached flagella.

pure culture depends simply on the degree of agitation of the water by bubbles from the diffuser. Figures 1 and 2 show cultures in serum bottles demonstrating free flocs due to turbulent aeration and attached flocs due to slight aeration.

The small size precludes determination of much cellular detail. Young cells (fig. 3) show a relatively homogenous cytoplasm with a few vacuoles. Often a few granules are seen. The vacuoles take up neutral red and are presumably sap vacuoles. Differential staining of granules with hematoxylin and acid stains has not been accomplished. Such chromatin as is present is in very small particles. In old cells the vacuoles become quite large and appear as white spaces after methylene blue, fuchsin, or hematoxylin staining. The filament sheath stains faintly with hematoxylin after Schaudinn's fixative, but not after Flemming with or without acetic acid. It does not stain with methylene blue or fuchsin. The reproductive cells (conidia), which are simply vegetative cells fragmented from a filament, have flagella which are very difficult to stain. We have not been able to demonstrate them with cytological fixatives, but by using air drying fixation followed by Gray's flagella stain they can be shown, as in

figure 4. Such conidia are then seen to have one to several long flagella, subapically inserted. Where there is apparently only one flagellum this is probably due to the aggregation of several on air drying. According to Bergey's Manual (*13*) motile conidia have a clump of flagella near one end.

These conidia are very active. They swim in only one direction and eventually attach themselves by one end, whereupon a long filament grows out from the substrate. Attachment is by the non-flagellated end, for attached conidia still move their free ends for a time. Conidia inoculated into a Petri dish of nutrient medium will grow into filaments several millimeters long overnight.

Colonies on sewage or nutrient agar are very delicate, irregular in contour, and rarely thick enough for a definite color to be seen. Occasionally on agar slants a gray or white color is seen.

The above morphological observations are largely in accord with those of Smit (*10*) and our preparations from agar and sludge so closely resemble his that further illustration of this nature seems unnecessary. But some cultural and physiologic differences are noteworthy. The demonstration of a sheath has been easily accomplished in our cultures. False branching has likewise been frequent, and swarming cells (conidia) have been produced in abundance with all our strains. Smit is not certain that his organism was *Sphaerotilus*, whereas ours corresponds closely to the original meager description of Kutzing and there is no doubt that ours is the predominant organism in such well-defined cases of bulking as we have seen. The question of attachment seems to depend, as stated above, merely on the degree of agitation in the culture flask. With slight turbulence most of the growth is on the walls of the containing vessel, but with an increase in turbulence most of the growth consists of unattached flocs of all sizes, very ragged and very light. If the air is shut off they settle slowly, but better than the flocs in bulking sludge. The slightest current keeps these flocs in suspension. This explains why *Sphaerotilus* is so objectionable in bulking. Growing out in all directions from sludge flocs, their buoyancy is greatly increased. The fungus also decreases the relative weight of the sludge flocs and assists in trapping air bubbles with which to produce a rising sludge.

Attempts to grow *Sphaerotilus* on a nidus other that the flocs of activated sludge have failed. Sawdust, as soon as waterlogged, settles to the bottom, and has so far failed to provide attachment. Asbestos has likewise failed to act as a center of attachment.

RELATIVE SETTLING RATES OF SOME SLUDGE ORGANISMS

We have found few other fungi to produce bulking experimentally. A branching form, possibly *Gleotrichoides paludosus* Smit, caused

bulking in a laboratory sludge. It appeared in May 1938, in a bottle of activated sludge to which 500 p. p. m. of glucose had been added periodically and gave a heavy growth for several days, during which time the settling power of the sludge was almost completely lost. Eventually the branching fungus was displaced by *Sphaerotilus*. Isolation of it on sewage agar showed a colorless aerial and subsurface mycelium, with moderate fruiting. On peptone agar the subsurface mycelium was yellow brown, the aerial white, and fruiting heavy. Fruiting and growth were heavy in synthetic sewage. Since it appeared only once in a lengthy series of experiments designed to produce bulking, it has not been further studied.

Several other fungi and organisms have been found to interfere with sludge settling but have not been studied extensively. Under laboratory conditions sludges have developed at times excessive growths of various branching fungi, filamentous bacteria, yeasts, and colonial vorticellid ciliates belonging to the genera *Epistylis* and *Opercularia*. Table 1 gives the relative time of settling of some of these in pure culture, using a synthetic sewage. In some cases (yeasts, *B. mycoides*) the effluent is turbid; in others the effluent is clear but contains large masses of suspended matter. This is true of the Phycomycete colonies shown in figure 5. In pure culture these form balls as large as marbles in aerating bottles of enrichment media and they will settle quickly. But if a current is present they remain in suspension and will pass out in the effluent. The senior author recalls that large colonies of *Opercularia* were rising and passing over the effluent weir at the Tenafly, N. J., sewage treatment plant some years ago.

TABLE 1.—*Relative time of settling of certain sewage organisms*

	Time required for—		
	10 percent settling	50 percent settling	90 percent settling
Sludge flocs alone	1 min	2 min	3-5 min.
Sphaerotilus on sludge flocs	30 min	1-2 hours	2-5 hours.
Sphaerotilus flocs	30 min	1-3 hours	3-12 hours.
Zooglea flocs	1 min	4 min	7 min.
Penicilium colonies	30 sec	1 min	1 min.
Other Phycomycete colonies	30 sec	1 min	1 min.
Yeast alone	30 min	12 hours	Indefinite.
Bacillus subtilis alone	No settling		
Bacillus mycoides alone	40 min	6 hours	12 hours.

NOTE.—The above rates of settling were determined by allowing the culture under investigation to stand in a 1-liter glass graduate.

Laboratory conditions under which the yeasts, *Bacillus subtilis* and *B. mycoides*, were produced in nonsettleable quantities rarely if ever obtain in sewage disposal plants. Table 1 indicates that organisms other than *Sphaerotilus* will rarely be found associated with or causing bulking.

FIGURE 5.—Ball-like nature of a branching fungus. The dense masses of mycelium settle quickly.

Sphaerotilus AND BULKING—CAUSE OR EFFECT?

Since bulking of activated sludge may occur in the absence of *Sphaerotilus,* it is not the cause of all bulking. But it is the most abundant organism in most cases of bulking. That it plays a part in this condition is quite evident from a comparison of the settling rate of *Sphaerotilus*-infested sludge flocs and sludge flocs with no *Sphaerotilus.* If we could identify and rectify the conditions leading to excessive growth of this fungus, we would undoubtedly cure many cases of bulking. With this in view, many substances were tested to see if they would stimulate the organism to excessive growth. Both mixed cultures and pure cultures were thus tested. The results are shown in table 2.

TABLE 2.—*Effects of various substances on growth of* Sphaerotilus

Mixed or pure culture	Basic medium	Substance added	Range in p. p. m.	Growth of *Sphaerotilus*	Settling quality	Condition of culture at end
Mixed	Activated sludge.	Sucrose	1,000–5,000 twice daily.	Good	Poor	*Sphaerotilus* dominant.
Do	do	do	1,000 four times daily.	do	do	*Sphaerotilus* replaced.
Do	do	do	5,000 four times daily.	do	do	Do.
Do	do	do	20,000 once only	Poor	do	Yeasts dominant.
Do	do	Glucose	1,000–5,000 twice daily.	Good	do	*Sphaerotilus* dominant.
Do	do	Starch	1,000–5,000 twice daily.	Poor	Good	Poor.
Do	do	Whole wheat	5,000 once only	do	do	Sludge good
Do	do	Peptone	100–1,000 once only.	Slight	do	*Sphaerotilus* replaced.
Do	do	Sulfite liquor	5 percent once only.	do	do	Do.
Pure	Sterile raw sewage.			Poor	Good	*Sphaerotilus* present.
Do	do	Sucrose	1,000–10,000 once only.	Good	Poor	*Sphaerotilus* thriving.
Do	do	do	1,000 four times	do	do	Do.
Do	do	Glucose	1,000–10,000 once only.	do	do	Do.
Do	do	do	1,000 four times daily.	do	do	Do.
Do	do	Maltose	1,000–10,000 once only.	do	do	Do.
Do	L+100 p. p. m. peptone.	Sucrose	50–1,000 once only	do	Fair	Do.
Do	do	do	10,000–60,000 once only.	Fair	No growth at 60,000.	
Do	do	Glucose	50–1,000 once only	Good	Fair	*Sphaerotilus* thriving.
Do	do	do	10,000–60,000 once only.	Fair	No growth at 60,000.	
Do	do	Maltose	50–10,000 once only.	Good	Fair	*Sphaerotilus* thriving.
Do	do	Lactose	do	do	do	Do.
Do	do	Glycerol	do	None		
Do	do	do	do	do		
Do	do	Whole wheat	100–40,000 once only.	Poor		
Do	do	White flour	1,000–5,000 once only.	None		
Do	do		100–5,000 once only.	do		
Do	L–6	Laundry soap	50–200 once only	Good		*Sphaerotilus* thriving.
Do	L	Sodium oleate	50–1,000 once only	None		
Do	L	Sodium stearate	do	do		
Do	L	Oleic acid	do	do		
Do	L	Stearic acid	do	do		
Do	L	Peptone	do	Fair	Fair	*Sphaerotilus* thriving.
Do	L	do	1,000–30,000 once only.	Poor to none.		

TABLE 2.—*Effects of various substances on growth of* Sphaerotilus—Continued

Mixed or pure culture	Basic medium	Substance added	Range in p. p. m.	Growth of *Sphaerotilus*	Settling quality	Condition of culture at end
Pure	L	Meat extract	500–1,000 once only.	do		
Do	L–6	NaCl	5–200 once only	Variable to poor.		
Do	L–6	Sulfite liquor	5 percent once only.	Good		
Do	L	Ammonium glycero-phosphate.	100–1,000 once only.	Slight		
Do	L, dextrose	Urea	50–100 once only	Good		
Do	Synthetic	Dextrose, 500 p. p. m.	Peptone 100 p. p. m. once only.	do	Fair	
Do	do	do		None		
Do	do	do	Urea, 100 p. p. m. once only.	Fair		
Do	do	Dextrose 1,000 p. p. m.	Glycerine 250 p. p. m. once only.	Slight		
Do	do	do	$NaNO_3$ 112 p. p. m. once only.	Fair		
Do	do	Dextrose 500 p. p. m.	l-tyrosine 100 p. p. m. once only.	Slight		
Do	do	do	l-cystine 100 p. p. m. once only.	do		
Do	do	do	l-asparagin 100 p. p. m. once only.	Good		
Do	do	do	l-leucine 50 p. p. m. once only.	Slight		
Do	do	do	dl-alanin 100 p. p. m. once only.	Good		
Do	do	do	d-glutamic acid 100 p. p. m. once only.	Very poor		
Do	do	do	Sarcosine 100 p. p. m. once only.	Slight		
Do	do	do	Creatine 100 p. p. m. once only.	Very poor		
Do	do	do	Sodium glycholate 100 p. p. m. once only.	Slight		
Do	do	do	Globulin 100 p. p. m. once only.	None		
Do	do	do	Isatin 100 p. p. m. once only.	do		
Do	do	do	Acetonitrile 100 p. p. m. once only.	do		
Do	do	do	dl-alanin 100 p. p. m. once only.	do		
Do	do	do	Na-gluconate 500 p. p. m. once only.	Fair		

Medium L—mineral salts and water.
Medium L–6—same as medium L, with dextrose and peptone added.
Medium synthetic—organic salts and water, no nitrate.

The following facts are shown by table 2: (1) It is possible to start with a normal activated sludge and by using heavy dosages of disaccharoses frequently to obtain a bulking sludge in which *Sphaerotilus* is very abundant. (2) Sugars will not always produce a heavy growth of *Sphaerotilus*. Sometimes other filamentous fungi grow excessively, or sometimes yeasts. Ruchhoft (*14*) has also shown that an activated sludge may be conditioned so that it will normally remove up to 1,000 p. p. m. of glucose without bulking or unusual growths of organisms. (3) No other substance tested produced heavy growths of *Sphaerotilus* in mixed culture. (4) Both mono- and di-saccharoses produced heavy growths of *Sphaerotilus* in pure culture. (5) No polysaccharose gave good growths in pure culture (6) Both organic and inorganic sources of N were utilized. (7) Peptone, alanin, and asparagin were the only nitrogenous substances giving a definite stimulus to growth

in pure culture. (8) Increasing the inorganic salt content from about 100 p. p. m. to about 300 p. p. m. did not materially affect growth, but above 300 p. p. m. a limiting effect on growth set in. (9) We have not been able to produce bulking experimentally without using high concentrations of substances not usually found in sewage. (10) We have not been able to produce growths comparable to those in polluted streams by using river water and adding small amounts of growth-stimulating substances.

The experimental work represented by table 2 suggests that excessive growth and consequent difficulty with this organism is not usually due to growth-promoting substances present in sewage. Exceptions are always possible, as shown by the experience of Morgan and Beck (*5*) at Maywood. It appears more probable that some feature of plant operation is likely to be the cause. In the case of a disposal plant troubled with bulking, a quick microscopic examination of the sludge, followed by a test for sugars either in raw sewage or sludge, might quickly determine whether the cause should be sought in the sewage or in plant operation.

SPECIFIC NUTRITIVE REQUIREMENTS

A basic medium was made up containing the following:

$NaNO_3$	25 mg.
K_2HPO_4	5 mg.
KH_2PO_4	5 mg.
$MgSO_4$	10 mg.
$CaCl_2$	45 mg.
Dextrose	1, 000 mg.
Distilled water	1 liter

This medium gave a slight growth although there was a great excess of sugar. It was then varied by leaving out one after another of the mineral salts, and in each case no growth resulted. Other variations were to leave out a salt, increasing the concentration of others. This again failed, except for the mono and dibasic potassium phosphate; 10 p. p. m. of either would support slight growth in the absence of the other provided the remaining three salts were present. The minimal growth threshold seems to be about 5 p. p. m. each of $NaNO_3$, KH_2PO_4, K_2HPO_4, $MgSO_4$, and $CaCl_2$, plus dextrose. Leaving out any one of the salts at this concentration stopped growth, and living *Sphaerotilus* could not be recovered from such a medium after 3 days' aeration. Any variation of this medium, using less than the eleven chemical elements contained therein, appeared not to support growth.

Maximum growth of the fungus appears possible on as little as 200 p. p. m. of mineral salts. Increasing salts beyond this, either with or without increasing the nitrogen and sugar, failed to increase the amount of fungus produced. The cell wall or colony sheath, and the

protoplasm of this organism apparently contain very little mineral matter.

Under laboratory conditions the greatest food requirements necessary to heavy growth seem to be sugars and organic nitrogen. If the synthetic sewage medium is made up with dextrose and no nitrogen, growth is not expected and does not occur; if glycine is substituted for the dextrose, no growth occurs; if peptone is substituted for the dextrose, poor growth results; but if both dextrose and peptone are present, heavy growth results, and some growth results if almost any combination of these two is used.

Nitrogen requirements of *Sphaerotilus* are also very general. Table 3 shows the sources of nitrogen which were tried and the relative growth produced. It will be noted that the best growths were secured from organic sources, alanin, asparagin, and peptone, but fair growths were also secured on the inorganic salts. This fungus thus presents a broad adaptability in its nutritive requirements and this characteristic is probably an important factor in making it such a successful inhabitant of rivers and sewage disposal plants. In addition to its wide nutritive range, it exhibits a relatively wide range of pH tolerance, growing between 5.5 and 8.0. It grows well in a solution of 200 p. p. m. of laundry soap, but only if dextrose and peptone are present, i. e., it does not use soap. Curiously enough, it apparently uses nitrogen freely in the formation of amines. Agar plates inoculated with *Sphaerotilus* and then placed in Novy jars will not grow if the air is exhausted, if nitrogen is substituted, or if CO_2 is substituted. No growth results in bottles into which nitrogen is bubbled, and thriving cultures are soon killed if nitrogen is substituted for the air. The same is true for methane. Evidently the plant is an aerobe, but a thriving culture in a substrate with abundant protein or peptone has a characteristic odor which our chemists (*14*) have stated to be due to primary amines. The organism thus dissimilates proteins or peptones in an anaerobic manner even in the presence of abundant oxygen. The oxidative processes of *Sphaerotilus* in relation to oxygen, sugar, and nitrogenous matter, and the building of protoplasm and cell walls (fungus cellulose) will be discussed in another paper.

TABLE 3.—*Forms of nitrogen used by* Sphaerotilus *in synthetic sewage* (*S. medium*)

Form of nitrogen	Growth	Form of nitrogen	Growth
Nitrites	None.	dl-alanin	Good.
Nitrates	Fair.	d-glutamic acid	Poor.
Ammonium salts	Do.	Isatin	None.
Urea	Do.	l-asparagin	Good.
Glycine	Poor.	Sarcosine	Poor.
l-tyrosine	Do.	Peptone	Good.
l-cystine	Do.	Gelatin	None.
l-leucine	Do.	Autoclaved wheat	Do.

CONTROL OF *Sphaerotilus*

Inasmuch as the organism grows excessively because of some substance in sewage or some defect in plant operation, knowledge of the cause and control of growth is useful, both for prevention and cure of the condition. Smith and Purdy (*15*) suggested chlorine for control of growth and it has since been extensively used with good results. Laboratory experiments were carried out by us to find, if possible, some specific killing agent for *Sphaerotilus*. The results are shown in table 4. None of the substances tried seem to be specific, although silver nitrate and some of the dyes are toxic at low concentrations, and malachite green, 5 p. p. m., is not toxic to a number of other organisms of the activated sludge community. Present cost of this dye would make its use prohibitive in comparison to chlorine; in fact, the relatively low cost of chlorine has discouraged any extensive search for killing agents. The method of using the chlorine depends largely on the individual plant, but it seems probable that chlorination of the returned sludge is most feasible.

TABLE 4.—*Effects of possible toxic agents on growth of* Sphaerotilus

Culture	Toxic agent	Method of application	Effect
Mixed activated sludge	Toluene vapor	Bubbled into normal sludge	None.
Mixed activated sludge, bulking.	do	Bubbled into bulking sludge	Do.
Do	Chloroform	do	Toxic.
L-6, heavy culture	Chlorine, as H. T. H.	Dosed to a residual of 0.5 p. p. m.	Do.
L-6, inoculated with *Sphaerotilus*.	Chlorine added	0.5 to 3.0 p. p. m. before inoculation.	No growth.
L-6, heavy culture	$AgNO_3$	0.5 to 2.5 p. p. m. added to heavy culture.	Toxic.
L-6, inoculated with *Sphaerotilus*.	do	0.5 to 2.5 p. p. m. before inoculation.	No growth.
Mixed activated sludge, good culture.	do	0.5 to 2.5 p. p. m. to heavy culture.	Toxic at 2 p. p. m.
Do	Phenol	1.0 p. p. m. to heavy culture	No effect.
Do	do	5.0 to 50 p. p. m. to heavy culture.	Toxic, variable.
L-6, heavy culture	do	1.0 p. p. m. to heavy culture	No effect.
Do	do	5.0 p. p. m. to heavy culture	Toxic.
Mixed activated sludge, good culture.	Acetic acid	50 p. p. m. to heavy culture	Do.
Do	Citric acid	100 to 1,000 p. p. m. to heavy culture.	*Sphaerotilus* replaced.
Do	Lactic acid	do	Do.
Do	Brilliant green	5-20 p. p. m. to heavy culture	Toxic at 5 p. p. m.
Do	Fast green	5-25 p. p. m. to heavy culture	Nontoxic.
Do	Malachite green	5-10 p. p. m. to heavy culture	Toxic at 5 p. p. m.
Do	Janus green	5-20 p. p. m. to heavy culture	Toxic at 20 p. p. m.
Do	Eosin W	5-15 p. p. m. to heavy culture	Variable.
Do	Methylene blue	5-20 p. p. m. to heavy culture	Toxic at 20 p. p. m.
Do	Gentian violet	5-15 p. p. m. to heavy culture	Toxic at 10 p. p. m.
Do	Uranin	5-200 p. p. m. to heavy culture	Nontoxic.

DISCUSSION

We have shown herein that the production of a bulking sludge by heavy dosages of sugars is relatively easy. Other substances have practically failed to produce such results.

Associated with bulking in most cases is the filamentous organism, *Sphaerotilus natans* Kutzing. Repeated isolations have succeeded in

producing but a single type of this organism. Butcher (*1*), studying polluted streams, called the species *natans* of Kutzing var. *typica*, and added four other varieties, but was of the opinion they were ecologic varieties. Organisms taken in the field by us have shown some variation, but when we have isolated them and grown them under similar conditions all have behaved alike, so it seems probable that the term "ecologic varieties" is well chosen. Smit (*10*) called his organism a *Sphaerotilus*, but noted some differences from the usual definition and reserved his opinion as to placing it definitely. Elsewhere (*16*) he described what is presumably his original organism as *Sph. paludosus*, without pseudodichotomous branching and no motile cells. Since all strains of our organism exhibit pseudodichotomous branching and form motile reproductive cells abundantly, it seems probable that our organism is *Sphaerotilus natans* Kutzing and that such cases of bulking as we have studied have been associated with *Sphaerotilus natans*. We have isolated an organism which agrees with Smit's *Sphaerotilus paludosus* morphologically, but so far it has refused to grow abundantly in the several synthetic media in use. Beger (*17*) found *Sphaerotilus natans* in activated sludge, but reported a new species which he named *tenuis* as more abundant. His description is very meager. He did not study pure cultures.

If Beger's species is valid, there appear to be five recognized species of *Sphaerotilus*—*S. tenuis* Beger, *S. paludosus* Smit, *S. natans* Kutzing, *S. dichotomus* (Cohn) Migula, and *S. fluitans* (Migula) Schikora. Our cultures illustrate the described morphological characteristics of *Sphaerotilus natans* very well, but not the nutritive characteristics. On the other hand, our organism has the same nutritive characteristics as *Sphaerotilus dichotomus*. *Sphaerotilus dichotomus* has been accepted by some workers as *Cladothrix dichotoma* Cohn. It is certainly closely related to *Sphaerotilus natans*, but we have been unable to isolate any organism close to *Sphaerotilus natans* which exhibits dichotomous branching. In our opinion *Sphaerotilus fluitans* should be further investigated before it is included as a separate species, and it appears that the whole group might be carefully investigated especially with regard to cultural characteristics.

CONCLUSIONS

It is possible to produce experimental bulking of activated sludge, such as occurs in sewage disposal plants by heavy dosages of sugars, or mixtures of nitrogenous and carbonaceous compounds. Such bulking may be associated with several organisms, but usually the predominant organism is the filamentous bacterium, *Sphaerotilus natans* Kutzing.

Only one species has been isolated in this laboratory, and its cultural characteristics have been constant, although field collections

from which some of these isolations were made have shown morphologic differences.

The organism has been shown to give abundant growth on solutions of sugar if a suitable source of nitrogen is present. Inorganic nitrogen is readily used, but only two of several amino acids, alanin and asparagin, have given good growth. Peptone has proved a good source of nitrogen.

No substance common, or apt to occur normally in sewage has been found which stimulates excessive growth.

A number of other fungi have been grown in pure culture but have not shown such poor settling qualities as *Sphaerotilus* and only yeasts, *Bacillus subtilis* and *Bacillus mycoides*, have shown a very slow settling rate.

Toxic effects toward *Sphaerotilus* of a number of substances have been investigated. No toxic substance cheaper or more available than chlorine has been found.

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AN UNIDENTIFIED DISEASE IN NEVADA BELIEVED TO BE TRANSMITTED BY RODENTS

Under date of May 1, 1940, Surgeon L. B. Byington, of the Public Health Service, reported the occurrence of an infectious disease in man in the Ruby Valley, Nev., believed to be associated with musk-rats, and designated by local physicians as "muskrat fever."

The clinical course of the disease, as described by local physicians, is as follows: The presenting complaint is a painful ulcer, practically always on the hand or forearm. This usually begins as a papule, which progresses to a vesicle and then to an ulcer. Frequently these ulcers are multiple. Fever begins with the onset of the papule and generally continues until recovery. The febrile course is not well known, as temperature charts have rarely been kept. The ulcers are accompanied by adenopathy, often requiring incision and drainage. The ulcers are chronic, necrotic, coalescing in type with a greenish serosanguinous exudate. The other symptoms are those common to any infection.

The degree of prevalence of the disease was not determined. The infection apparently occurs in persons living in the vicinity of Ruby Lake, a large swamp 60 miles south of Wells, Nev., where large numbers of muskrats and beavers are trapped. The trappers were the persons principally infected, although physicians report the occurrence of the malady in children and women not associated with rodent trapping. The disease is stated to occur only during the trapping season in the fall and winter. So far as known, no deaths have been reported to have resulted from it.

At the time of the brief investigation made in March of this year, there were no human cases available for study, and few animal specimens could be secured, as parts of the valley were inaccessible on account of snow. The results of agglutination tests (against *P. pestis*, *B. tularense*, and *Br. abortus* and *melitensis*) of blood samples from persons recovered from the disease and inoculation of laboratory animals with animal tissue and ectoparasites were negative, except that tests pointed to tularaemia in one or two cases.

Although the results of the investigation were not conclusive, after including some of the cases as possibly being simple furunculosis, there was evidence of a rodent-transmitted infection. Further study will be necessary to establish the identity and epidemiology of the disease.

COURT DECISION ON PUBLIC HEALTH

Food inspection ordinance held invalid.—(Kansas Supreme Court; *McCulley et al.* v. *City of Wichita et al.*, 98 P.2d 192; decided January 27, 1940.) An ordinance of the city of Wichita made it "unlawful for

any person, firm, or corporation engaged in the retailing of either cooked or uncooked perishable foods, or foods subject to contamination, to sell, offer for sale, or expose for sale such foods at any time other than the hours of the day and the days of the week when inspection of such foods and the places where such foods are sold is available by the health department of the city." Under the ordinance such inspection was to be provided each day from Monday through Friday during the hours from 7 a. m. to 6:30 p. m., and on Saturday from 7 a. m. to 9 p. m. By its terms the ordinance did not apply to "foods cooked, baked, or prepared on the premises for immediate consumption on or off the premises" nor to milk, ice cream, and frozen desserts. Further, it was provided in section 2 that "The term either cooked or uncooked perishable foods or foods subject to contamination when used in this ordinance shall apply only to such foods as are usually sold under the classification of provisions, groceries or meats."

To determine the validity of the ordinance an action under the declaratory judgment act was brought by certain residents of the city engaged in the grocery business against the city and its officers. In a second cause of action it was sought to enjoin the enforcement of the ordinance. The trial court concluded that the ordinance was based upon an arbitrary classification, constituted an unwarranted and unreasonable interference with the carrying on of lawful business, and was unconstitutional. On appeal to the supreme court the judgment of the lower court in favor of the plaintiffs was affirmed.

The appellate court said that it thought it quite apparent that section 2 of the ordinance "was about as clearly designed to prohibit operators of grocery stores and meat markets from functioning at other than the specified hours as if such operators had been specifically named" and that it was evident that "the first exemption was as clearly intended for the benefit of operators of hotels, restaurants, coffee shops, hamburger stands, drug stores, or other similar places where foods are prepared for sale, as though they had been definitely named." The court cited examples to illustrate the unreasonableness in the classification of foods and the discriminatory and oppressive effect of the ordinance upon a legitimate business and then said:

> While municipalities have authority to enact ordinances designed to safeguard and protect the public health, discriminations as to particular classifications of food or business affected by such enactments must be based upon real and substantial distinctions and not upon fictitious distinctions which have no reasonable or substantial relation to the public health or general welfare of the inhabitants. This court, on numerous occasions, has considered and denied the power of municipalities to enact ordinances relating to various subjects where the ordinance did not conform to the above principle. See *City of Atchison* v. *Beckenstein*, 143 Kans. 440, 54 P.2d 926, wherein former cases of this court were reviewed. In those cases it was held the ordinance was violative of both the State and Federal constitutions. The instant ordinance is invalid for the same reasons.

DEATHS DURING WEEKS ENDED MAY 11 AND 18, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

Week ended May 11, 1940

	Week ended May 11, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,617	8,612
Average for 3 prior years	8,370	
Total deaths, first 19 weeks of year	175,331	175,368
Deaths under 1 year of age	518	525
Average for 3 prior years	509	
Deaths under 1 year of age, first 19 weeks of year	9,716	10,252
Data from industrial insurance companies:		
Policies in force	65,659,862	67,406,340
Number of death claims	12,097	15,187
Death claims per 1,000 policies in force, annual rate	9.6	11.7
Death claims per 1,000 policies, first 19 weeks of year, annual rate	10.6	11.7

Week ended May 18, 1940

	Week ended May 18, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,390	8,009
Average for 3 prior years	8,185	
Total deaths, first 20 weeks of year	183,711	183,377
Deaths under 1 year of age	492	463
Average for 3 prior years	499	
Deaths under 1 year of age, first 20 weeks of year	10,214	10,715
Data from industrial insurance companies:		
Policies in force	65,523,880	67,365,626
Number of death claims	12,182	15,201
Death claims per 1,000 policies in force, annual rate	9.7	11.8
Death claims per 1,000 policies, first 20 weeks of year, annual rate	10.5	11.4

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MAY 25, 1940

Summary

As compared with the preceding week, slight increases are shown during the current week in the incidence of poliomyelitis, typhoid fever, and whooping cough, and decreases for the other six important communicable diseases reported in the following table. The current incidence of each of these nine diseases, except influenza and poliomyelitis, is below the 5-year (1935–39) median expectancy—smallpox (57 cases) less than one-fourth of the median (269 cases) and meningococcus meningitis (25 cases) about one-fifth of the median (120 cases).

Washington State reported 10 cases of poliomyelitis, California 9 cases, and Michigan 2 cases. No other State reported more than 1 case. Pennsylvania reported 5 cases of meningococcus meningitis (all in Luzerne County), but no other State reported more than 2 cases. Of 57 cases of smallpox, Iowa reported 15, Tennessee 8, and Wisconsin 6 cases. Of 141 cases of typhoid fever, Pennsylvania reported 15 (16 last week), and Georgia and Louisiana 14 cases each. A total of 19 cases of Rocky Mountain spotted fever were reported for the current week, of which 18 occurred in the northwestern States and 1 case in North Carolina. Of 23 cases of endemic typhus fever, 7 cases each were reported in Georgia and Texas and 5 cases in Alabama.

For the current week the Bureau of the Census reports 8,280 deaths in 88 large cities, as compared with 8,390 for the preceding week and with 8,232 for the 3-year (1937–39) average for the corresponding week.

Telegraphic morbidity reports from State health officers for the week ended May 25, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	May 25, 1940	May 27, 1939		May 25, 1940	May 27, 1939		May 25, 1940	May 27, 1939		May 25, 1940	May 27, 1939	
NEW ENG.												
Maine	1	0	0	------	------	2	449	106	156	0	0	0
New Hampshire	0	0	0	------	------	------	28	0	3	1	0	0
Vermont	1	0	0	------	------	------	13	168	140	0	0	0
Massachusetts	3	2	0	------	------	------	869	943	697	0	1	2
Rhode Island	0	0	0	------	------	------	188	133	70	0	0	0
Connecticut	2	1	2	3	1	1	17	818	219	1	3	0
MID. ATL.												
New York	20	21	28	[1] 7	[1] 8	[1] 5	888	2,181	2,904	0	5	5
New Jersey	7	7	7	4	5	5	990	48	708	0	1	3
Pennsylvania	17	23	35	------	------	------	453	141	1,909	5	6	8
E. NO. CEN.												
Ohio	9	11	11	7	------	5	25	67	1,241	1	1	9
Indiana	1	8	8	1	3	7	5	13	159	2	0	3
Illinois	16	36	36	3	54	54	174	44	417	0	0	4
Michigan [2]	4	10	12	2	6	2	0	667	667	1	1	2
Wisconsin	7	0	1	53	35	22	1,162	785	785	0	2	1
W. NO. CEN.												
Minnesota	1	0	1	1	5	1	140	254	350	0	0	0
Iowa	4	3	3	------	4	1	416	207	207	0	0	0
Missouri	5	9	9	6	------	25	25	22	30	0	0	0
North Dakota	0	1	1	------	2	2	5	109	32	0	0	0
South Dakota	0	2	1	------	8	------	2	210	4	0	0	0
Nebraska	1	2	1	------	8	------	16	354	191	0	0	0
Kansas	3	5	3	1	------	1	392	97	97	0	1	1
SO. ATL.												
Delaware	1	0	0	------	------	------	0	13	12	0	0	0
Maryland [2, 3]	3	3	5	4	3	3	17	165	165	1	0	4
Dist. of Col.	2	3	11	------	------	------	4	316	146	0	0	0
Virginia	6	3	10	57	26	------	286	474	465	2	0	6
West Virginia [3]	6	9	5	9	17	28	32	7	93	2	1	1
North Carolina [4]	3	9	9	4	3	3	110	715	298	0	1	2
South Carolina [3]	5	2	3	299	244	104	5	12	62	2	0	0
Georgia [3]	7	8	0	23	54	------	112	72	26	0	0	0
Florida	1	6	6	3	27	3	152	0	19	0	0	0
E. SO. CEN.												
Kentucky	3	9	7	12	9	9	113	35	148	0	1	2
Tennessee	5	2	5	16	12	16	133	40	40	0	0	2
Alabama [3]	2	1	8	34	31	14	165	149	119	2	2	2
Mississippi [3]	2	6	4	------	------	------	------	------	------	1	1	1
W. SO. CEN.												
Arkansas	2	4	4	16	23	38	30	71	71	0	2	0
Louisiana [3]	1	4	12	13	7	7	4	100	24	2	0	1
Oklahoma	3	1	4	21	17	18	13	175	65	0	1	1
Texas [3]	13	23	26	126	179	138	1,350	482	216	1	2	3
MOUNTAIN												
Montana [4]	0	1	2	9	10	10	81	232	84	0	0	0
Idaho [4]	0	2	0	------	3	3	40	79	14	0	0	0
Wyoming [4]	0	0	0	3	------	------	16	71	26	0	1	0
Colorado [4, 5]	16	8	7	2	12	------	29	231	231	0	1	1
New Mexico	4	0	3	8	1	2	87	10	43	0	0	0
Arizona [3]	1	2	0	55	40	31	118	21	22	0	0	0
Utah [2, 4]	0	0	0	------	3	2	507	73	50	0	0	0
PACIFIC												
Washington [4]	0	3	3	------	------	------	502	1,300	286	1	0	0
Oregon	3	0	1	10	28	21	519	83	83	0	1	0
California	8	24	24	64	31	32	272	2,285	1,612	0	0	7
Total	199	280	370	876	914	608	10,963	14,587	14,587	25	35	120
21 weeks	6,849	9,031	10,693	164,052	146,309	135,752	161,950	288,402	288,402	848	1,003	2,995

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 25, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	May 25, 1940	May 27, 1939		May 25, 1940	May 27, 1939		May 25, 1940	May 27, 1939		May 25, 1940	May 27, 1939	
NEW ENG.												
Maine	0	0	0	13	14	14	0	0	0	0	0	0
New Hampshire	0	0	0	3	4	7	0	0	0	0	0	0
Vermont	0	0	0	4	5	5	0	0	0	0	1	0
Massachusetts	0	0	0	120	157	204	0	0	0	4	0	1
Rhode Island	0	0	0	4	6	16	0	0	0	0	4	0
Connecticut	0	0	0	75	51	98	0	0	0	0	4	1
MID. ATL.												
New York	1	1	1	948	486	703	0	15	0	5	10	6
New Jersey	0	0	0	362	221	181	0	0	0	1	1	2
Pennsylvania	1	0	0	401	274	564	0	0	0	15	8	8
E. NO. CEN.												
Ohio	1	0	0	213	300	300	0	11	1	7	8	8
Indiana	0	0	0	115	94	90	1	25	9	6	5	2
Illinois	0	1	1	797	364	512	2	10	10	4	5	5
Michigan [2]	2	1	1	268	440	381	0	10	0	3	3	3
Wisconsin	0	0	0	149	161	289	6	1	5	1	0	2
W. NO. CEN.												
Minnesota	0	0	0	74	73	130	4	11	11	1	0	0
Iowa	0	0	0	78	61	88	15	41	33	1	6	4
Missouri	0	0	0	37	55	55	2	44	11	3	1	1
North Dakota	0	0	0	6	7	32	1	1	2	1	0	1
South Dakota	0	0	0	6	8	11	2	17	10	0	0	0
Nebraska	0	0	0	7	25	47	0	6	6	1	1	0
Kansas	0	0	0	60	53	84	0	11	28	0	2	1
SO. ATL.												
Delaware	0	0	0	4	4	6	0	0	0	0	1	1
Maryland [2 3]	0	0	0	23	26	50	0	0	0	1	3	3
Dist. of Col	0	0	0	26	13	15	0	0	0	0	1	1
Virginia	0	0	0	26	5	17	0	0	0	5	5	5
West Virginia [2]	0	1	0	34	24	28	0	0	0	4	0	5
North Carolina [4]	0	0	1	8	18	16	0	0	0	4	3	6
South Carolina [3]	1	22	0	5	6	4	0	0	0	1	6	6
Georgia [3]	0	3	1	12	6	7	0	0	0	14	8	8
Florida	1	1	1	3	7	4	1	0	0	2	7	7
E. SO. CEN.												
Kentucky	1	1	1	30	24	24	0	2	0	5	8	8
Tennessee	0	0	0	71	25	9	8	38	0	8	1	5
Alabama [3]	1	0	1	6	5	5	1	2	0	1	1	4
Mississippi [3]	0	1	0	6	1	4	0	0	0	3	2	4
W. SO. CEN.												
Arkansas	0	0	0	5	4	5	0	9	9	1	3	3
Louisiana [3]	1	1	1	6	10	10	0	1	0	14	8	10
Oklahoma	0	0	0	6	16	16	3	6	2	2	6	6
Texas [3]	0	0	0	24	21	49	4	6	5	7	14	9
MOUNTAIN												
Montana [4]	0	1	0	15	14	21	0	2	12	1	2	0
Idaho [4]	1	0	0	10	4	4	0	0	6	1	0	1
Wyoming [4]	0	0	0	1	4	13	0	0	2	0	0	0
Colorado [4 5]	0	0	0	20	44	45	3	2	3	3	2	2
New Mexico	0	0	0	7	10	11	1	0	0	1	0	1
Arizona [3]	0	2	0	10	11	11	1	2	0	0	1	1
Utah [2 4]	1	0	0	10	15	20	1	0	0	0	0	0
PACIFIC												
Washington [4]	10	0	0	37	36	38	0	4	4	0	2	1
Oregon	1	0	0	10	9	22	0	2	4	4	2	2
California	9	2	4	117	133	202	1	17	16	6	10	5
Total	32	38	22	4,272	3,354	5,438	57	296	269	141	150	156
21 weeks	497	451	432	100,689	101,249	140,683	1,498	7,311	6,508	1,811	2,510	2,510

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended May 25, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended— May 25, 1940	Whooping cough, Week ended— May 27, 1939	Division and State	Whooping cough, Week ended— May 25, 1940	Whooping cough, Week ended— May 27, 1939
NEW ENG.			SO. ATL.—continued		
Maine	34	178	South Carolina [3]	23	61
New Hampshire	4	2	Georgia [3]	11	32
Vermont	36	47	Florida	15	29
Massachusetts	161	95			
Rhode Island	7	42	E. SO. CEN.		
Connecticut	37	81	Kentucky	88	9
MID. ATL.			Tennessee	64	38
New York	313	410	Alabama [3]	28	70
New Jersey	100	342	Mississippi [2]	----------	----------
Pennsylvania	277	232			
E. NO. CEN.			W. SO. CEN.		
Ohio	200	181	Arkansas	12	33
Indiana	27	92	Louisiana [3]	54	26
Illinois	87	219	Oklahoma	31	23
Michigan [2]	195	239	Texas [3]	434	186
Wisconsin	108	125			
W. NO. CEN.			MOUNTAIN		
Minnesota	40	44	Montana [4]	0	30
Iowa	50	23	Idaho [4]	16	2
Missouri	21	24	Wyoming [4]	5	0
North Dakota	3	1	Colorado [4 5]	9	80
South Dakota	4	0	New Mexico	67	40
Nebraska	7	27	Arizona [3]	75	18
Kansas	63	28	Utah [2 4]	200	52
SO. ATL.			PACIFIC		
Delaware	10	11	Washington [4]	83	22
Maryland [2 3]	106	40	Oregon	20	19
Dist. of Col.	5	27	California	462	187
Virginia	66	85	Total	3,805	3,806
West Virginia [3]	60	24			
North Carolina [4]	87	250	21 weeks	66,492	83,808

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended May 25, 1940, 23 cases, as follows: Maryland, 1; South Carolina, 1; Georgia, 7; Alabama, 5; Louisiana, 1; Texas, 7; Arizona, 1.
[4] Rocky Mountain spotted fever, week ended May 25, 1940, 19 cases, as follows: North Carolina, 1; Montana, 4; Idaho, 1; Wyoming, 8; Colorado, 1; Utah, 2; Washington, 2.
[5] Colorado tick fever, week ended May 25, 1940, Colorado, 3 cases.

WEEKLY REPORTS FROM CITIES

City reports for week ended May 11, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Data for 90 cities:											
5-year average	137	107	44	6,485	606	2,108	21	397	25	1,272	--------
Current week [1]	75	75	17	3,216	379	2,671	1	362	12	1,020	--------
Maine:											
Portland	0	------	0	182	2	0	0	0	0	1	22
New Hampshire:											
Concord	0	------	0	2	1	0	0	0	0	0	17
Manchester	0	------	0	0	0	1	0	0	0	0	16
Nashua	6	------	0	9	0	0	0	0	0	0	5
Vermont:											
Barre	0	------	0	0	0	0	0	0	0	0	2
Burlington	0	------	0	0	0	0	0	0	0	0	11
Rutland	0	------	0	0	0	0	0	0	0	0	2
Massachusetts:											
Boston	1	------	0	147	13	67	0	10	0	73	102
Fall River	0	------	0	38	1	0	0	3	0	5	28
Springfield	0	------	0	2	1	7	0	0	0	6	35
Worcester	2	------	0	28	2	9	0	0	0	4	48
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	14
Providence	0	------	0	112	2	8	0	0	0	2	54
Connecticut:											
Bridgeport	0	------	0	0	2	3	0	0	0	0	30
Hartford	1	------	0	2	2	9	0	1	0	2	32
New Haven	0	------	0	0	2	5	0	0	0	7	42
New York:											
Buffalo	0	------	0	4	7	18	0	5	0	8	131
New York	19	16	0	244	84	744	0	94	2	90	1,574
Rochester	1	3	0	5	0	24	0	1	0	7	63
Syracuse	0	------	0	0	0	9	0	1	0	1	59
New Jersey:											
Camden	1	------	0	0	4	18	0	1	0	0	35
Newark	0	1	0	418	3	44	0	0	0	21	100
Trenton	0	------	0	1	1	6	0	2	0	4	37
Pennsylvania:											
Philadelphia	3	------	0	107	14	130	0	27	1	25	546
Pittsburgh	4	1	2	2	12	19	0	6	0	12	166
Reading	0	------	0	1	0	0	0	0	0	11	22
Scranton	0	------	--------	0	-------	1	0	-------	0	0	--------
Ohio:											
Cincinnati	3	1	1	0	2	13	0	10	0	25	160
Cleveland	1	12	0	5	8	68	0	9	1	29	188
Columbus	4	2	2	1	1	8	0	3	0	4	104
Toledo	0	1	0	0	3	69	0	2	0	6	74
Indiana:											
Anderson	0	------	0	0	0	3	0	0	0	3	8
Fort Wayne	0	------	0	7	3	0	0	1	0	3	30
Indianapolis	0	------	3	5	5	15	0	4	0	10	106
Muncie	0	------	0	0	2	2	1	0	0	0	10
South Bend	0	------	0	0	0	4	0	0	0	0	16
Terre Haute	0	------	0	0	0	2	0	2	0	0	18
Illinois:											
Alton	0	------	0	0	0	0	0	0	0	4	7
Chicago	4	1	1	66	26	458	0	48	0	58	743
Elgin	0	------	0	0	1	1	0	0	0	0	9
Moline	0	------	0	1	0	0	0	1	0	0	13
Springfield	0	------	0	2	3	3	0	0	0	0	25
Michigan:											
Detroit	1	2	1	191	13	85	0	21	1	93	293
Flint	0	------	0	11	4	21	0	0	0	4	29
Grand Rapids	0	------	0	9	2	17	0	0	0	21	38
Wisconsin:											
Kenosha	0	------	0	63	0	2	0	0	0	0	11
Madison	0	------	1	37	1	5	0	0	0	2	9
Milwaukee	0	------	0	106	4	22	0	3	0	0	98
Racine	0	------	0	0	0	1	0	0	0	6	23
Superior	0	------	0	64	0	0	0	0	0	0	5

[1] Figures for Galveston estimated: report not received.

City reports for week ended May 11, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	21	0	1	0	0	0	0	22
Minneapolis	0	------	0	2	6	18	0	0	0	13	83
St. Paul	0	------	0	2	1	2	0	2	0	6	60
Iowa:											
Cedar Rapids	0	------	------	32	------	0	0	------	0	3	------
Davenport	0	------	------	2	------	3	0	------	0	3	------
Des Moines	0	------	0	22	0	9	4	0	0	0	30
Sioux City	1	------	------	0	------	0	0	------	0	0	------
Waterloo	1	------	------	8	------	2	0	------	0	3	------
Missouri:											
Kansas City	0	------	0	10	4	6	0	4	0	0	94
St. Joseph	0	------	0	0	4	3	0	0	0	0	37
St. Louis	4	------	0	1	18	20	0	3	1	15	216
North Dakota:											
Fargo	0	------	0	0	0	0	0	0	0	0	6
Grand Forks	0	------	------	0	------	0	0	------	0	3	------
Minot	0	------	0	0	0	0	0	0	0	0	4
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	0	------
Sioux Falls	0	------	0	0	0	2	0	0	0	0	12
Nebraska:											
Lincoln	1	------	------	3	------	1	0	------	0	2	------
Omaha	0	------	0	8	2	5	0	2	0	7	37
Kansas:											
Lawrence	0	------	0	0	0	0	0	1	2	1	8
Topeka	0	------	0	21	0	1	0	0	0	0	3
Wichita	0	------	0	11	3	0	0	0	0	14	34
Delaware:											
Wilmington	0	------	0	0	3	2	0	0	0	0	24
Maryland:											
Baltimore	0	------	0	1	7	13	0	9	0	109	222
Cumberland	0	------	0	0	0	2	0	0	0	0	7
Frederick	0	------	0	0	0	0	0	0	0	0	5
District of Columbia:											
Washington	4	1	1	5	13	47	0	15	0	12	165
Virginia:											
Lynchburg	0	------	0	0	1	1	0	0	0	6	9
Norfolk	0	2	0	108	3	4	0	0	0	9	18
Richmond	0	------	1	0	0	3	0	1	0	2	57
Roanoke	0	------	0	11	2	4	0	2	0	9	20
West Virginia:											
Charleston	0	------	0	0	2	0	0	0	1	0	17
Wheeling	3	------	------	2	------	0	0	------	0	0	------
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	0	1	6	0	1	0	0	9
Wilmington	0	------	0	0	1	0	0	1	0	0	16
Winston-Salem	0	------	0	0	0	1	0	1	0	0	11
South Carolina:											
Charleston	0	2	1	0	2	0	0	1	0	0	20
Florence	0	------	0	0	2	0	0	0	0	0	9
Greenville	0	------	0	0	1	0	0	1	0	0	8
Georgia:											
Atlanta	0	2	0	11	5	4	0	6	0	3	81
Brunswick	0	------	0	0	0	0	0	0	1	0	3
Savannah	0	10	1	1	1	0	0	2	0	0	31
Florida:											
Miami	0	------	0	1	0	0	0	2	0	0	39
Tampa	0	------	0	70	0	0	0	1	0	0	25
Kentucky:											
Ashland	0	------	0	1	1	0	0	0	0	1	9
Covington	0	------	0	2	1	0	0	0	0	0	15
Lexington	0	------	0	22	0	1	0	0	0	4	17
Louisville	1	------	0	8	7	44	0	2	0	48	85
Tennessee:											
Knoxville	0	------	2	4	1	11	0	1	0	0	36
Memphis	0	5	0	22	2	10	0	5	0	14	88
Nashville	0	------	1	2	4	1	0	1	0	4	40
Alabama:											
Birmingham	0	2	0	5	6	1	0	3	1	2	82
Mobile	0	------	0	0	2	0	0	5	0	0	23
Montgomery	0	------	0	4	------	2	0	------	0	0	------

City reports for week ended May 11, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	-----	-------	0	-------	0	0	-------	0	0	--------
Little Rock	0	------	0	1	4	0	0	2	0	0	--------
Louisiana:											
Lake Charles	0	------	0	0	0	0	0	0	0	0	10
New Orleans	0	2	0	8	14	4	0	15	0	29	149
Shreveport	0	------	0	0	1	0	0	4	1	0	44
Oklahoma:											
Oklahoma City	0	-----	0	0	2	2	0	1	0	4	47
Tulsa	0	------	--------	6	-------	0	0	-------	0	17	--------
Texas:											
Dallas	2	------	0	478	3	1	0	3	0	33	49
Forth Worth	0	------	0	3	1	1	0	1	0	50	41
Galveston	------	------	-------	-------	-------	-------	-------	-------	-------	-------	--------
Houston	2	------	0	26	4	7	0	3	1	4	73
San Antonio	0	1	0	6	9	1	0	3	0	3	80
Montana:											
Billings	0	------	0	0	2	0	0	0	0	0	7
Great Falls	0	------	0	17	2	2	0	0	0	0	7
Helena	0	------	0	0	0	0	0	0	0	0	2
Missoula	0	------	0	0	0	4	0	0	0	1	7
Idaho:											
Boise	0	------	0	0	0	0	0	0	0	0	10
Colorado:											
Colorado Springs	0	------	0	1	1	1	0	1	0	0	7
Denver	3	------	2	23	4	9	0	4	0	5	94
Pueblo	0	------	0	11	2	3	0	1	0	0	7
New Mexico:											
Albuquerque	0	------	0	0	0	0	0	4	0	17	13
Utah:											
Salt Lake City	0	------	0	262	2	2	1	0	1	96	26
Washington:											
Seattle	0	------	0	309	2	5	0	1	0	20	77
Spokane	0	------	0	4	1	2	0	0	0	0	37
Tacoma	0	------	0	7	4	12	0	0	0	0	26
Oregon:											
Portland	1	------	0	135	0	2	2	1	0	6	70
Salem	0	------	--------	2	-------	0	0	-------	0	0	--------
California:											
Los Angeles	7	7	0	19	3	24	0	0	0	43	300
Sacramento	5	------	0	7	1	3	0	1	0	19	25
San Francisco	0	4	0	6	6	8	0	8	0	19	164

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Rhode Island:				North Carolina:			
Providence	0	1	0	Wilmington	1	0	0
Iowa:				Louisiana:			
Sioux City	1	0	0	New Orleans	1	0	0
New York:				Texas:			
Buffalo	2	0	0	Houston	3	0	0
New York	2	1	1				
Maryland:							
Baltimore	1	0	0				

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Charleston, W Va., 1; Great Falls, 2; San Francisco, 1.

Pellagra.—Cases: Atlanta, 11; Savannah, 4; Los Angeles, 1.

Rabies in man.—Deaths: Memphis, 1.

Typhus fever.—Cases: Savannah, 2; Mobile, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended April 27, 1940.—During the week ended April 27, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		2		3	3	1	1	2		12
Chickenpox		6	8	200	320	30	11	12	102	689
Diphtheria				24	2	5	1		3	35
Dysentery				24						24
Influenza		31			29		2		7	69
Measles	2	1		214	334	544	272	10	60	1,437
Mumps		3		26	401	4	15	1	16	466
Pneumonia	4	7			14		4		15	44
Poliomyelitis									2	2
Scarlet fever		6	10	126	124	15	6	16	4	307
Trachoma						2			2	4
Tuberculosis	3	15	13	77	62	11	22	8		211
Typhoid and paratyphoid fever			1	17	8	3		1	1	31
Whooping cough		32	2	110	118	24	59	18	23	386

CUBA

Habana—Communicable diseases—4 weeks ended May 4, 1940.—During the 4 weeks ended May 4, 1940, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	9	1	Tuberculosis		2
Scarlet fever	1		Typhoid fever	83	9

FINLAND

Communicable diseases—4 weeks ended March 23, 1940.—During the 4 weeks ended March 23, 1940, cases of certain communicable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	284	Poliomyelitis	10
Dysentery	1	Scarlet fever	651
Influenza	1,848	Typhoid fever	11
Paratyphoid fever	32		

PANAMA CANAL ZONE

Notifiable diseases—January–March 1940.—During the months of January, February, and March 1940, certain notifiable diseases were reported in the Panama Canal Zone and terminal cities as follows:

Disease	January		February		March	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Chickenpox	7		13		17	
Diphtheria	2		8		8	
Dysentery (amoebic)	12		3	2	5	1
Dysentery (bacillary)	6	2	5		2	1
Leprosy	3	1	1		1	
Malaria	271	6	205	6	102	3
Measles	1		1			
Meningococcus meningitis	2	1				
Mumps	5		1		2	
Paratyphoid fever			1		1	
Pneumonia		15		8		13
Poliomyelitis	3					
Relapsing fever	1		1			
Scarlet fever	1					
Tuberculosis		30		30		34
Typhoid fever					2	
Typhus fever					3	

SWITZERLAND

Notifiable diseases—February 1940.—During the month of February 1940, cases of certain notifiable diseases were reported in Switzerland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	110	Paratyphoid fever	2
Chickenpox	150	Poliomyelitis	3
Diphtheria	86	Scarlet fever	502
German measles	55	Tuberculosis	277
Influenza	5,627	Typhoid fever	2
Lethargic encephalitis	1	Undulant fever	9
Measles	1,377	Whooping cough	184
Mumps	118		

Vital statistics—Year 1939.—The following table shows the number of marriages, births, and deaths in Switzerland during the year 1939:

Number of marriages	31,513	Deaths from—Continued.	
Number of births	63,837	Heart disease	7,456
Number of deaths	49,484	Influenza	1,994
Deaths from:		Pneumonia	2,794
Arteriosclerosis	6,229	Suicide	1,001
Cancer	6,631	Tuberculosis	3,363

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place		January-February 1940	March 1940	April 1940—week ended—			
				6	13	20	27
ASIA							
India		7,774					
Bassein	C					2	10
Calcutta	C	258	282	72	78	49	69
Madras	C	1					
Porto Novo	C	1					
Rangoon	C	20	10		1		
India (French)	C	6	2				
Indochina (French)	C	315	121				
Thailand	C	52	180	1		1	

PLAGUE

[C indicates cases; D, deaths]

Place		January-February 1940	March 1940	April 1940—week ended 6	13	20	27
AFRICA							
Belgian Congo	C	3					
British East Africa:							
Kenya	C	6					
Uganda	C	35	14				
Egypt	C	99	141	38	19	32	26
Madagascar	C	283	62				
Morocco [1]	C						
Rhodesia, Northern	C	1					
Senegal: Dakar	D				[2] 1		
Union of South Africa	C	4	2	6			
ASIA							
Dutch East Indies: Java and Madura	C	98					
India	C	6,556					
Bassein	C	1	7		1	3	3
Cochin	C	1					
Plague-infected rats		3					
Rangoon	C	[3] 1	3				
Indochina (French)	C	2					
Thailand:							
Bangkok	C	3					
Bisnulok Province	C	3					
Dhonpuri Province	C	1					
Jayanad Province	C	3					
Kamphaeng Bajr Province	C	28	1				
Kanchanapuri Province	C	8	4				
Nagara Svarga Province	C	22	8				
Noangkhay Province	C		4				
Sukhodaya Province	C	15	7				
EUROPE							
Portugal: Azores Islands	C	2					
NORTH AMERICA							
United States. (See issue of May 17, p. 907.)							
SOUTH AMERICA							
Argentina:							
Salta Province	C	1	1				
Santiago del Estero Province	C				[2] 5		
Peru:							
Lambayeque Department	C	[4] 5					
Libertad Department	C	[4] 25					
Lima Department	C	[4] 11					
Piura Department	C	[4] 3					
Venezuela.[5]							
OCEANIA							
Hawaii Territory: Plague-infected rats		6	4			2	

[1] A report dated May 11, 1940, stated that there was an epidemic of bubonic plague in southern Morocco, where several hundred cases had been unofficially reported.
[2] Imported.
[3] Reported as glandular plague.
[4] For the month of January only.
[5] For the period Dec. 7, 1939, to Jan. 4, 1940, 11 cases of plague with 8 deaths were reported from the interior of Venezuela.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX

[C indicates cases; D, deaths]

Place		January-February 1940	March 1940	April 1940—week ended—			
				6	13	20	27
AFRICA							
Algeria	C		1				
Angola	C	[1] 20					
Belgian Congo	C	792	212	90	95		
British East Africa	C	3					
Dahomey	C	17					
French Guinea	C				13		
Gibraltar	C		[2] 1				
Ivory Coast	C	[3] 66	31				
Nigeria	C	687	141				
Niger Territory	C	146	156				
Nyasaland	C	5	1				
Rhodesia, Southern	C	80	20	4			
Senegal	C	14	53				
Sierra Leone	C		5				
Sudan (Anglo-Egyptian)	C	103	101	12	6	36	30
Union of South Africa	C	45	1				
ASIA							
Arabia	C	95	160				
China	C	240	128	43	37	9	51
Chosen	C	11					
Dutch East Indies—Sabang	C		4				
India	C	39,420					
India (French)	C	5					
Indochina (French)	C	607	103				
Iran	C	54	38				
Iraq	C	57	25	3	9	2	17
Japan	C		[4] 202				
Straits Settlements	C	1					
Sumatra	C		1				
Thailand	C			2	1	2	
EUROPE							
Great Britain	C	2					
Greece	C	16					
Portugal	C	40					
Spain	C	144	51				
Turkey	C	53					
NORTH AMERICA							
Guatemala	C	1					
Mexico	C	22	18				
SOUTH AMERICA							
Brazil	C	1					
Colombia	C	99					
Venezuela (alastrim)	C	54	31				

[1] For January only.
[2] Imported.
[3] For February only.
[4] For January, February, and March.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER

[C indicates cases; D, deaths]

Place		January-February 1940	March 1940	April 1940—week ended— 6	13	20	27
AFRICA							
Algeria	C	313	254		115	108	
Belgian Congo	C	1,188	6		16		
British East Africa	C	1					
Egypt	C	670	1,038	116	214		179
Morocco	C	44	108	16	20	6	22
Tunisia	C						247
Union of South Africa	C	74					
ASIA							
China	C	58	215				
Chosen	C	5					
India	C	1					
Iran	C	102	64				
Iraq	C	3	26	2	8	29	4
Palestine	C	13	7	3	4	3	
Trans-Jordan	C	13					
EUROPE							
Bulgaria	C	41	7	4	1		4
Germany	C		24				
Greece	C	2	4	6	2		
Hungary	C	13	23	6	6	2	2
Lithuania	C	22					
Rumania	C	566	302	24	40	32	13
Spain	C	3					
Turkey	C	320					
Yugoslavia	C	91	64				
NORTH AMERICA							
Guatemala	C	99	28				
Mexico	C	127	52				
Panama Canal Zone	C		3				
SOUTH AMERICA							
Chile	C	30	6				
Ecuador	C		1	1			
Venezuela	C	3	1				
OCEANIA							
Australia	C	6	2				
Hawaii Territory	C	4	3		2	1	2

YELLOW FEVER

[C indicates cases; D, deaths]

Place		January-February 1940	March 1940	April 1940—week ended— 6	13	20	27
AFRICA							
Cameroon: Nkongsamba	C	[1] 1					
French Equatorial Africa: Fort Archambault	C	[1] 1					
Gold Coast	C			1			
Ivory Coast	C	1					
Nigeria:							
Enugu	C			[1] 1			
Oshogbo.[2]							
SOUTH AMERICA							
Brazil:							
Espirito Santo State	D	[3] 28					
Rio de Janeiro State	D	[3] 1					
Colombia:							
Antioquia Department—San Luis	D	2					
Caldas Department—							
La Pradera	D	1					
Samana	D		1				
Victoria	D	1					

[1] Suspected.
[2] During the week ended May 4, 1940, 1 suspected case of yellow fever was reported in Oshogbo, Nigeria.
[3] Jungle type.

X

Public Health Reports

VOLUME 55 JUNE 7, 1940 NUMBER 23

IN THIS ISSUE

U.S. PUBLIC HEALTH SERVICE 1798

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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Public Health Reports

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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

April 21–May 18, 1940

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the Public Health Reports under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended May 18, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935–39.

With the exception of influenza, the incidence during the 4 weeks ended May 18 of all of the eight communicable diseases under consideration was again below the median expectancy for the period.

Influenza.—While the number of cases of influenza (5,650) was only about 50 percent of the number reported for this period in 1939, the incidence was about 15 percent in excess of the 1935–39 median figure for this period. The disease was most prevalent in the South Atlantic and West South Central regions. In the South Atlantic region the number of cases (2,012) was more than twice the average incidence for preceding years, but in the West South Central region the number (1,792) was slightly below the seasonal expectancy. While the number of cases in the Mountain region was not large, it was almost twice the median figure for the period; in all other regions the situation was favorable.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—The incidence of diphtheria was the lowest on record for this period. For the 4 weeks ended May 18 there were 927 cases reported as compared with 1,221, 1,486, and 1,544 cases for the corresponding period in 1939, 1938, and 1937, respectively. The current incidence is less than 60 percent of the 1935–39 median figure for this period.

Measles.—The number of cases (44,682) of measles reported during the current period was about 70 percent of the number reported for the corresponding period in 1939 (approximately 62,000 cases), which

figure also represents the 1935–39 median figure for this period. The West South Central and Mountain regions reported rather significant increases over the normal seasonal expectancy, but in all other regions the incidence was comparatively low.

Number of reported cases of eight communicable diseases in the United States during the 4-week period Apr. 21–May 18, 1940, the number for the corresponding period in 1939, and the median number of cases reported for the corresponding period 1935–39 [1]

Division	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median
	Diphtheria			Influenza [2]			Measles [3]			Meningococcus meningitis		
United States [1]	927	1,221	1,544	5,650	10,725	4,939	44,082	61,913	61,913	189	154	504
New England	26	31	47	12	322	30	5,193	9,550	9,550	9	11	15
Middle Atlantic	187	242	314	88	82	69	8,123	9,231	19,616	48	44	82
East North Central	144	273	289	444	617	617	6,619	5,701	9,189	11	20	63
West North Central	84	75	118	71	271	271	4,077	5,269	5,209	14	5	35
South Atlantic	152	177	244	2,012	3,796	926	2,817	9,119	6,126	28	25	116
East South Central	58	81	124	517	1,753	664	1,559	1,209	2,110	32	14	52
West South Central	159	159	237	1,792	3,016	1,842	5,873	3,656	2,719	19	23	23
Mountain	50	72	72	453	492	229	4,054	3,956	3,412	23	7	11
Pacific	67	111	119	261	376	376	6,367	14,222	9,618	5	5	20
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States [1]	66	149	78	19,830	15,980	24,641	280	1,229	1,142	415	521	532
New England	1	1	3	1,195	1,094	1,417	0	0	0	29	20	20
Middle Atlantic	7	6	6	7,653	4,606	6,574	0	1	0	80	59	64
East North Central	7	8	9	7,004	6,236	8,241	35	354	226	75	71	71
West North Central	5	3	3	1,106	1,445	3,064	107	440	463	19	20	26
South Atlantic	8	95	15	819	573	767	7	5	5	58	89	106
East South Central	5	9	7	638	411	265	28	29	7	48	65	54
West South Central	6	11	11	207	299	426	51	243	61	57	119	124
Mountain	5	2	2	437	454	525	32	59	128	21	30	30
Pacific	22	14	14	771	862	1,034	20	98	172	26	42	42

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 44 States and New York City.
[3] 47 States. Mississippi is not included.

Meningococcus meningitis.—The incidence of meningococcus meningitis was slightly above that reported for the corresponding period in 1939, but in relation to the preceding 5-year average it was relatively low, the number of cases (189) for the current period being less than 40 percent of the average figure (504 cases) for this period. Of the 23 cases reported from the Mountain region, 19 occurred in New Mexico; the 1935–39 median figure for New Mexico for this period is only 5 cases.

Poliomyelitis.—For the 4 weeks ended May 18 there were 66 cases of poliomyelitis reported, as compared with 149, 64, and 78 cases for the corresponding period in 1939, 1938, and 1937, respectively. The Pacific region reported a few more cases than might normally be expected at this time, but in all other regions the situation was favorable.

Scarlet fever.—The number of cases (19,830) of scarlet fever reported for the current period represented an increase of approximately 20 percent over the number reported for the corresponding period in 1939, but the incidence remained well below the 1935-39 median incidence for this period (approximately 25,000 cases). Increases over the normal seasonal incidence were reported from the Middle Atlantic, South Atlantic, and East South Central regions, but in all other regions the incidence was below the seasonal expectancy.

Smallpox.—The incidence of smallpox was the lowest on record for this period. There were 280 cases reported, as compared with 1,229, 1,571, and 1,142 cases for the corresponding period in 1939, 1938, and 1937, respectively. Alabama reported 22 of the total of 28 cases reported from the East South Central region.

Typhoid fever.—The number of cases (415) of typhoid fever was the lowest reported for this period in the 12 years for which these data are available. The North Atlantic and East North Central regions reported some increase over the seasonal expectancy, but in other regions the incidence was relatively low. The South Atlantic and West South Central regions reported very significant declines from the 1935-39 median figures for this period.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended May 18, based on data received from the Bureau of the Census, was 11.4 per 1,000 inhabitants (annual basis). The rate was slightly higher than the rate for the corresponding period in each of the 2 preceding years. The 1935-39 average rate for this period was 11.8.

DISINSECTIZATION OF AIRCRAFT

By C L WILLIAMS, *Assistant Surgeon General, United States Public Health Service*

For some years, the Public Health Service has been actively engaged in the development of methods for destroying insects, particularly mosquitoes, on aircraft from foreign ports. Three specific objects have been aimed at: To prevent the introduction of mosquitoes infected with yellow fever from South American ports; to prevent the introduction of *Anopheles gambiae* from eastern South America into the southern part of the United States; and to prevent the introduction of any *Anopheles* from the west coast of the United States into the Hawaiian Islands.

In two papers published in 1935,[1] Williams and Dreessen describe the problem presented and recommend the use of a concentrated

[1] The destruction of mosquitoes in airplanes By C L. Williams and W C Dreessen Pub Health Rep, vol 50, No 20, May 17, 1935, pp 663-671. A nonflammable pyrethrum spray for use in airplanes. By C L. Williams and W. C. Dreessen. Pub. Health Rep, vol. 50, No. 41, Oct. 11, 1935, pp. 1401-1404.

pyrethrum spray which had been shown to be highly toxic to mosquitoes while practically innocuous to human beings. Based on this work, all planes coming from South America during the past few years have been sprayed throughout the fuselage while in flight en route from the last foreign stop to a United States port. The spraying has been done with a hand sprayer by the steward, the ventilating system of the airplane being cut off for a period of 10 minutes.

Careful inspections of airplanes on arrival at Miami, Fla., have shown that very few live mosquitoes have been brought into that port since the spraying in flight was instituted. Despite this, however, it is felt that the method is not entirely satisfactory for several reasons, the more important being that the spraying is not accomplished under the surveillance of a disinterested Government official, that the presence of passengers renders it difficult to direct the spray adequately into all of the remote recesses of the fuselage, and that certain compartments, such as the space under the limber boards, cannot be readily opened and sprayed in flight.

The airplanes traveling from northern South America, the Canal Zone, and Mexico City to Brownsville, Tex., were for some time sprayed while resting on the ground overnight at Mexico City and again while on the ground at Tampico. Careful inspection of these on arrival at Brownsville showed very few live mosquitoes, and apparently the method was a successful one.

Airplanes departing from San Francisco for Honolulu have been sprayed while resting on the water with the passengers aboard immediately before departure. This spraying has been done by a representative of the Public Health Service, and, it is believed, has been quite thorough in practically all instances. On arrival at Honolulu the discovery of live mosquitoes has been rare.

It has appeared that probably the best protection would be afforded by a very careful and thorough spraying of the interior of airplanes at a point removed both from infected territory and from the nearest United States port. It appeared that thereby a definite barrier could be set up against mosquitoes coming from infected areas, although it might not prevent the transportation of mosquitoes infesting the port at which the spraying itself was done, and which might come aboard following disinsectization. As long as such mosquitoes were either not infected or were not of a species that it was desired to keep out of the country, their transportation would be a matter of no quarantine significance.

With these considerations in mind, the Public Health Service has adopted, for the control of mosquitoes carried by aircraft from the eastern coast of South America, a method of spraying airplanes on the water at Port of Spain, Trinidad. This spraying is very carefully done with a power apparatus under the surveillance of a Public Health

Service inspector, who certifies that the spraying was properly performed. The procedure is as follows: A trained member of the Pan American Airways' ground personnel at Port of Spain carries aboard the plane an air-pressure sprayer which has been especially developed for the purpose, and after closing all openings to the outside and opening up all spaces inside the fuselage, including the bilges (the limber boards being raised), he proceeds to spray thoroughly the entire interior of the aircraft. The sprayer used permits accurate dosage, and an amount of insecticide is used double that which has been shown by experiment to be sufficient to kill 100 percent of exposed mosquitoes. As soon as all of the insecticide has been sprayed, the man operating the apparatus leaves the airplane, closing the hatch behind him, and the airplane is kept closed for 10 minutes. At the end of the 10 minutes, the airplane is opened and the crew goes aboard and begins preparations for departure. In a few minutes, the passengers come aboard, and within one-half hour from the time the spraying was begun, the airplane takes off.

By this method, it is felt that any mosquitoes that may have been brought by an airplane from South America are destroyed. It is true, of course, that mosquitoes infesting Trinidad may enter the plane after it is opened following disinsectization, even though the period before departure is only about 15 or 20 minutes. Mosquitoes entering at Trinidad, however, are not of present quarantine significance. Furthermore, tests of this method at Miami under laboratory conditions indicate that the residual insecticide in the aircraft to some extent repels mosquitoes that may attempt to enter and probably kills most of those that do enter.

At present, most of the airplanes leaving Trinidad for the United States proceed nonstop to San Juan, P. R. On arrival at that port, they are carefully inspected to determine whether any live mosquitoes are aboard. Between San Juan and Miami, stops are generally made at San Pedro de Macoris in the Dominican Republic, Port au Prince in Haiti, and Antilla in Cuba. None of these points is believed infested with mosquitoes that are of present quarantine significance. On arrival at Miami, the airplane is again carefully inspected to determine the presence of live mosquitoes. When sufficient data have been gathered, the results of these inspections will be published.

A NEW INSECTICIDE SPRAYER FOR AIRCRAFT

One of the difficulties in spraying aircraft has been to secure a sprayer with which relatively small amounts of insecticide could be accurately measured while spraying was in progress. This is necessary because most of the large aircraft are divided into compartments, and it is desired to introduce reasonably accurate doses into each

compartment. Another difficulty with air-pressure sprayers available has been that, upon closure of the air valve, some of the insecticide dripped from the nozzle. A third difficulty has been to secure a spray sufficiently fine that it might be regarded as dry, that is, that it would not deposit on walls and fabrics.

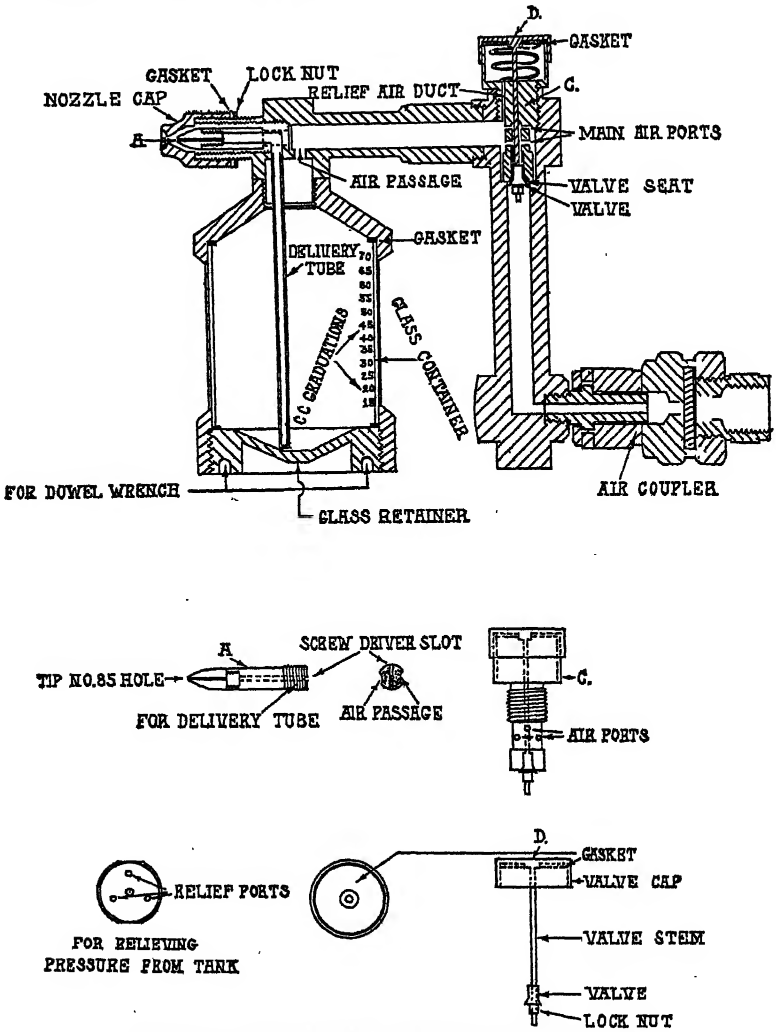

FIGURE 1.—Diagrammatic drawing showing construction of sprayer.

With these considerations in mind, Sanitary Engineer H. A. Johnson, about 3 years ago, designed a sprayer in which were incorporated a relatively small reservoir for the insecticide, an air valve that included a bleeder tube to relieve pressure on the insecticide when the air valve was closed, and a very fine spray orifice for the insecticide.

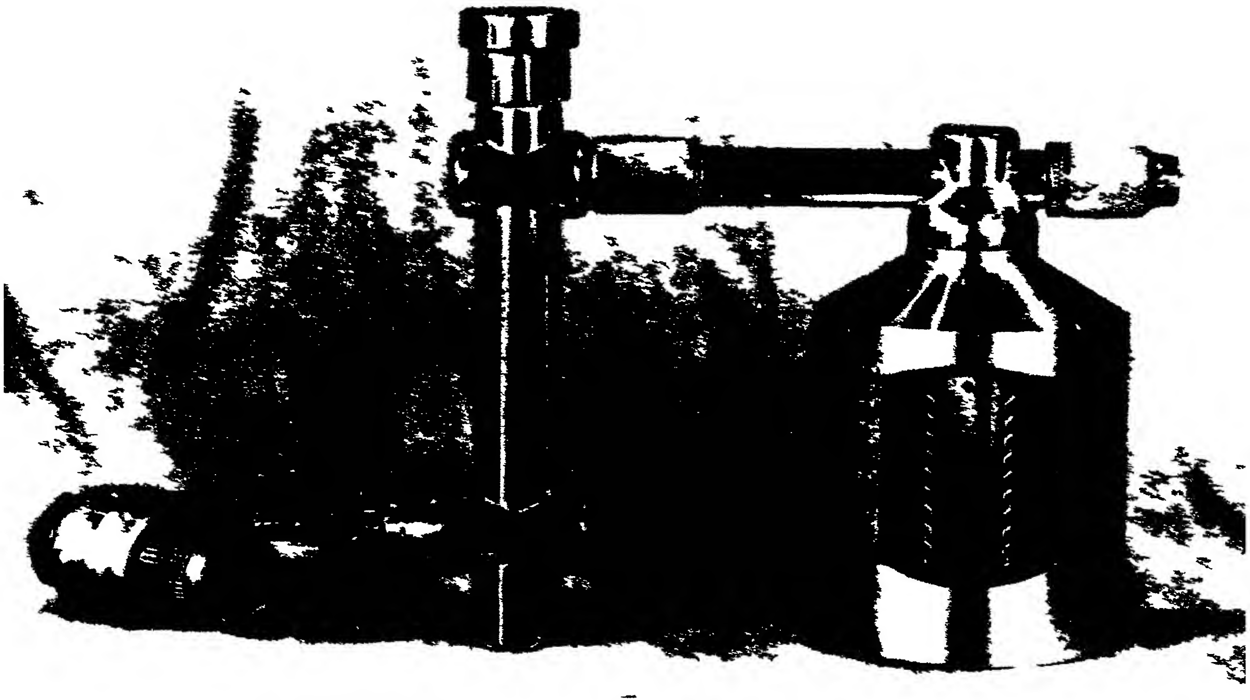

FIGURE 2 —The finished sprayer

FIGURE 3 —The sprayer in use in an airplane

Due to a change of duties, Mr. Johnson was not able to complete the development of this apparatus.

Utilizing Mr. Johnson's plans, Passed Assistant Surgeon G L. Dunnahoo developed this sprayer for practical use and carried it with him to Trinidad when the spraying procedure described above was instituted. It is this sprayer that is now in use for spraying airplanes at Trinidad, and it is expected that it will be put into use for similar spraying of airplanes at other points in the Caribbean area, as well as in Mexico and on the west coast of the United States

The first essential feature of the apparatus is a very fine orifice at the spray nozzle through which insecticide is forced under pressure into a mixing chamber where it is further broken up by a blast of air under pressure coming from all sides. The air and the atomized insecticide then pass out through a somewhat larger opening in the cap of the spray nozzle. The spray produced is a mist and for practical purposes is not deposited on any surfaces. The cap of the nozzle can be adjusted closer to, or farther away from, the fine orifice, and with a lock nut can be set at any point of adjustment. The cap can be removed entirely for cleaning and the piece containing the fine orifice can also be readily removed. Should the small opening be stopped by a bit of dirt such as even filtering might not remove, it can be quickly cleared by removing this piece and reversing it in the stream of air under pressure.

The next essential feature is the bleeder connected with the air valve, which is opened when the air valve is closed. This bleeder is a small tube from the top of the insecticide reservoir to the outside through the air-valve mechanism. When the air valve is closed, air pressure on the insecticide is relieved through the bleeder tube. This prevents dripping at the nozzle.

The third essential feature is the use of a glass container for the insecticide set in a protective metal cover, through which have been cut windows so that the level of the insecticide may be observed. On the edge of the windows are calibrations from which the amount of insecticide contained in the reservoir can be read at a glance. The protective cover is constructed of a cylinder of dural metal open at the bottom and conical at the top, where it is threaded to fit into the sprayer. It is of such size that a glass cylinder will fit snugly inside of it. At the bottom a threaded disc with a gasket is screwed down on the lower rim of the glass cylinder. The glass cylinder is of a standard size and may be readily replaced if broken. The reservoirs at present in use hold 50 cc., but larger ones may be constructed, and probably will be, for use on the larger aircraft now being developed.

The air valve is of the push type, conveniently mounted, and is operated by the thumb of the person using the sprayer. A toggle valve will probably be used on larger sprayers. Air under pressure is

brought to the sprayer by a hose that fits in at the bottom of the handle. The best attachment is by means of a "Kwick-air" valve, which can be attached or removed by one-eighth turn of a milled sleeve.

The sprayer may be operated by compressed air at pressures from 25 to 50 pounds, but is most efficient when pressures between 30 and 40 pounds are used.

Figure 1 is a diagrammatic drawing, with explanatory notes, of the construction of the sprayer, figure 2 is a photograph of the finished apparatus, and figure 3 shows the sprayer in use.

STUDIES IN CHILDBIRTH MORTALITY

I. PUERPERAL FATALITY AND LOSS OF OFFSPRING [1]

By J. Yerushalmy, *Statistician, United States Public Health Service*, M. Kramer, *Assistant Statistician*, and E. M. Gardiner, *Director, Division of Maternity, Infancy, and Child Hygiene, New York State Department of Health*

Maternal deaths have rarely been studied in conjunction with all the births from which they arise. For example, the most extensive and valuable investigations in this country, the New York City study (*1*), and the Children's Bureau study in 15 States (*2*), are limited for the most part to an analysis of maternal deaths only. The distribution of maternal deaths according to the factors under investigation, when a similar distribution for the surviving mothers is not known, does not afford a measure of the risk of death associated with these factors. In fact, such evaluation is lacking not only for specific factors but also for the total risk of death due to childbearing. The maternal mortality rate, as ordinarily defined, is not strictly a measure of this risk; for, in the population exposed to risk, it neglects all pregnancies terminating in abortion or miscarriage, while the maternal deaths from these conditions are included. Even more restricted is our knowledge concerning the hazard to the mother associated with specific conditions such as the number of her previous pregnancies, her age, outcome of pregnancy (live birth, stillbirth, neonatal death), premature birth, and so on. If, in addition to the maternal deaths, the population exposed to risk were known in each case, the probability of death associated with such factors could be obtained. One valuable source from which information of this kind may be extracted is the birth certificate and the maternal death certificate. By themselves, these records are of limited value for study

[1] From the Division of Public Health Methods, National Institute of Health, U. S. Public Health Service, and the Division of Maternity, Infancy, and Child Hygiene, New York State Department of Health.

The authors are indebted to Miss S. Elizabeth Shearar of the New York State Department of Health for her assistance in the preparation of the tables, and to Dr. Carroll E. Palmer of the U. S. Public Health Service and Dr. Allan F. Guttmacher of Johns Hopkins University for reading the manuscript and offering valuable suggestions.

purposes since the death certificate contains very little information concerning the birth. However, when the maternal death certificate is matched with the infant's birth certificate, a considerable amount of additional data becomes available. The same information is obtainable also for the births in which the mother survived and, thus, correlated investigation may be undertaken. This process of matching birth and death certificates was used in studying various phases of the problem of neonatal mortality and stillbirths (*3*, *4*, *5*, *6*), and it was shown by various tests (*4*) that such errors as might have been entered on the birth certificate are not selective for the problems under investigation and that they are not of sufficient magnitude to affect the results seriously. The same method will, therefore, be used to investigate certain aspects of maternal mortality.

The procedure of matching birth and maternal death certificates is limited in that only the risk of death associated with the delivery of a viable offspring[2] can thus be studied. The fatality associated with abortions, miscarriages, ectopic pregnancies, and that of women who die undelivered cannot be studied by this method since no birth certificate is filed for these conditions. In order to avoid confusion with the term maternal mortality, the deaths of mothers who were delivered either of a live or stillbirth (per 10,000 total deliveries, including those of stillbirths) will be referred to as "puerperal fatality rate."[3] This expression, puerperal fatality, appears to have certain advantages. It has the same meaning as the usual "case fatality rate," in the sense that it measures the mortality among a group of people all of whom are exposed to a given condition. It also parallels the meaning generally assigned to a case fatality rate in that it is restricted only to the length of time in which the condition exists (the postpartum period) whereas a mortality rate implies a calendar period of time (usually 1 year).[4] It should be noted that the puerperal fatality rate is more nearly a measure of the risk of death associated with the delivery of a viable offspring, and should be a useful index in connection with the maternal health problem.

The investigation of various aspects of the problem of puerperal fatality will be presented in a series of papers of which this is the first. In these papers an attempt will be made to study puerperal fatality in its relation to such factors as outcome of pregnancy (live birth, stillbirth, neonatal death), premature birth, sex of infant, order of birth, age of mother, mother's previous infant losses, and so

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[2] The term "viable offspring" will be used in this paper to denote a fetus which advanced at least to the fifth month of utero-gestation born alive or dead.

[3] The term "puerperal fatality" was suggested by Dr. Carroll E. Palmer of the U. S. Public Health

[4] Likewise, the ratio of maternal deaths due to abortion, miscarriage, and the like, to all women in the pregnant state may be termed "pregnancy fatality rate," and the ratio of all maternal deaths to all pregnant women may be designated as "maternal fatality rate."

on. For comparison, puerperal fatality rates will be paralleled in most cases with the stillbirth and neonatal mortality rates.

SCOPE OF THE STUDY

This series of studies is based on over a quarter of a million deliveries, and nearly 700 deaths which resulted from these deliveries, occurring in New York State (exclusive of New York City) in the 3-year period 1936–38. The information was obtained currently from birth and death certificates received by the New York State Department of Health. The names of all women who died from a puerperal cause were searched in the index of births to determine whether they were delivered of a live birth or of a stillbirth. When a birth certificate could not be found, additional searches were made to ascertain that no birth occurred. In most of these cases it was possible to determine from the statement on the death certificate the outcome of pregnancy, that is, whether pregnancy terminated in an abortion or miscarriage, whether it was ectopic, or whether the woman died undelivered. Similar searches were made in the file of birth certificates to ascertain the names of all infants who died under 1 month of age. The information from each of the matched birth and death certificates was brought together on a single punch card.

Only births and deaths occurring in New York State (exclusive of New York City) to resident mothers are included, since deaths of nonresidents which occurred after the mother and infant returned to their usual place of residence would not be found in the records of the State Department of Health. Since all births in the 3-year period 1936–38 form the basis of the study, only the deaths of mothers and infants associated with deliveries during this period are included. Deaths of mothers and infants occurring in 1936 but arising out of births in 1935 are excluded, and death of mothers and infants occurring in 1939 arising from births in 1938 are included.

THE DISTRIBUTION OF MATERNAL DEATHS BY OUTCOME OF PREGNANCY

During the 3-year period 1936–38, a total of 255,727 resident mothers of New York State were delivered of 258,525 live and still births.[5] In the same period there occurred 1,122 deaths of women in which the primary cause of death was recorded as puerperal. The maternal mortality rate was therefore 43.4 per 10,000 total births (including stillbirths). A thorough search of the vital statistics files produced birth and stillbirth certificates for 689 deliveries in which death of the mother occurred, or 61.4 percent of the 1,122 maternal deaths. Of the remaining 433 deaths for which no birth certificate could be found, it was possible to establish with reasonable certainty,

[5] There were 2,754 pairs of twins and 22 sets of triplets.

from the statements on the death certificate, that 224 (20.0 percent of the maternal deaths) were associated with abortion or miscarriage, 74 (6.6 percent) were ectopic pregnancies, and 93 (8.3 percent) of the mothers died undelivered. There were 24 additional women who probably died undelivered. In the remaining 18 cases, it was questionable whether death was associated with the delivery of a viable offspring or with an abortion or miscarriage. Since no birth or stillbirth certificate could be found in the New York State files, it is possible that a certain number of these women were delivered of a viable offspring in New York City or out of the State. It is possible also that some of these represent unregistered births.

It may be of interest to utilize the maternal deaths associated with abortion for the purpose of testing the estimates of the frequency of abortion and of the puerperal fatality associated with this condition. Taussig (7) proposes the following as estimates: The ratio of abortions (spontaneous and induced) to confinements 1–2.5 in urban localities and 1–5 in the rural districts; the mortality associated with abortions, 1.2 percent. Taussig also assumes that there are as many deaths from abortion which are concealed under nonpuerperal causes as there are registered deaths from this condition. Following Taussig's first assumption, the number of abortions which occurred in upstate New York would be as follows:

Locality	Confinements	Ratio of abortions to confinements	Estimated number of abortions
Urban	129,898	1-2 5	51,959
Rural	125,829	1-5	25,165
Total	255,727		77,124

The total number of abortions in the 3-year period would therefore be 77,124. If Taussig's 1.2 percent fatality rate for abortions is accepted, the expected number of maternal deaths from this cause would be 77,124 × .012, a total of 925. The actual number accounted for was 224, with the possibility that all the 18 questionable cases were also due to abortion. When these 18 cases are added, a total of 242 registered deaths associated with this condition is obtained. If the assumption that there were an equal number of concealed deaths from abortion is accepted, there would be 484 deaths from abortion, whereas the estimated number is 925. For New York State, exclusive of New York City, it would appear either that abortions may not be as frequent as the above estimates indicate or that the mortality from abortions is lower than is assumed.

PUERPERAL FATALITY

For the study of puerperal fatality, maternal deaths associated with abortion, miscarriage, ectopic pregnancy, and women who die undelivered are excluded. There remain the 689 deaths which occurred among the 255,727 mothers who were delivered either of a live birth or a stillbirth. This paper, therefore, deals primarily with puerperal fatality in the sense described above, that is, with the risk of death to the mother who is delivered either of a live or a stillbirth. The criterion for distinguishing a stillbirth from a miscarriage is that the former has been registered as a stillbirth. Such registration, according to New York State law, is required if the fetus "advanced to the fifth month of utero-gestation."

The puerperal fatality rate in the 3-year period was 26.9 per 10,000 confinements.

TABLE 1.—*Distribution of deaths of mothers of viable offspring by primary and secondary causes of death—New York State (exclusive of New York City), 1936–38*

Secondary causes of death	International list numbers	Primary causes of death (International List Numbers,[1] 1929 revision)										
		141[2]	144 (a)	144 (b)	145	146	147	148	149 (a)	149 (b)	150	Total
Puerperal causes (total)	141–150	15	26	40	85	51	20	3	16	15	----	280
Abortion without septic condition[2]	141[2]	----	5	----	1	21	4	2	----	2	----	35
Placenta praevia	144 (a)	----	----	----	7	----	----	----	----	----	----	7
Other hemorrhages	144 (b)	8	----	----	12	----	----	----	----	8	----	28
Puerperal septicemia	145	----	----	----	----	----	----	----	----	----	----	----
Puerperal albuminuria and eclampsia	146	1	2	6	10	----	----	----	----	----	----	19
Other toxemias	147	----	1	4	3	5	----	----	----	1	----	14
Puerperal embolism and thrombosis	148	----	8	4	13	7	3	1	16	3	----	50
Cesarean operation	119 (a)	6	13	11	33	19	9	----	----	1	----	92
Other accidents of childbirth	119 (b)	----	2	21	5	2	3	----	----	----	----	33
Other and unspecified	150	----	----	----	1	----	1	----	----	----	----	2
Nonpuerperal causes (total)	----------	25	3	18	46	32	13	19	34	60	1	251
Diseases of the heart	90–95	4	2	7	9	13	5	10	12	14	----	76
Pneumonia (all forms)	107–109	5	----	3	7	6	2	1	5	17	1	47
Diseases of the digestive system	115–129	1	1	----	5	3	1	----	12	7	----	30
Cerebral hemorrhage	82	1	----	----	----	2	4	1	----	7	----	15
Chronic nephritis	131	7	----	2	----	----	----	1	2	----	----	12
Diseases of the female genital organs	139	----	----	----	7	----	----	----	----	----	----	7
Anemia	71	3	----	----	1	----	1	1	----	1	----	7
Other	----------	4	----	6	17	8	----	5	3	14	----	57
Total secondary causes	----------	40	29	64	131	86	33	22	50	75	1	531
No secondary cause	----------	----	9	35	26	33	6	31	5	12	1	158
Total	----------	40	38	99	157	119	39	53	55	87	2	689

[1] For convenience of printing, only the International List Numbers are given. The causes which these numbers represent are given under "secondary causes."
[2] Under this classification come also accidents of pregnancy of mothers of viable offspring.

Causes of puerperal fatality.—Table 1 gives the distribution of the 689 maternal deaths according to the primary and secondary causes of death as given on the death certificate and as classified by the Division of Vital Statistics according to the "Manual of Joint Causes of Death" (1929 Revision). It should be noted that the selection, by means of set rules, of a primary cause of death, when several causes

are stated on the death certificate, results in a classification of primary causes of death which is somewhat different from that of hospital statistics (*8*, *9*), or that obtained from personal interview with the physician (*2*). The primary causes fall into four main groups: Toxemias of pregnancy (158 deaths), puerperal septicemia (157 deaths), accidents of childbirth (142 deaths), and puerperal hemorrhage (137 deaths). Accidents of pregnancy [6] (40 deaths) and puerperal embolism and thrombosis (53 deaths) are responsible for the remaining deaths.

A somewhat different picture of the causes of maternal deaths is obtained when the secondary causes are considered. The distribution of the mothers dying *from* the various puerperal causes is different from that of the mothers dying *with* these causes. The addition of the frequencies with which a certain cause appears both as primary and as secondary cause of death gives the total frequency with which that cause occurred among the 689 deaths. The relative standing of the 4 main groups of causes in terms of total frequency and as primary causes appears as follows:

Group of causes	Number of times appearing as primary cause	Total number of times appearing on certificate
Toxemias of pregnancy	158	191
Puerperal septicemia	157	157
Accidents of childbirth	142	267
Puerperal hemorrhage	137	172

Thus, in terms of total frequency, accidents of childbirth were in first place, while as a primary cause of death they were in third place. Septicemia, which was the second largest in the primary group, was the smallest group in terms of total frequency. The most striking change occurred in cesarean operation which appeared on a total of 147 certificates but was coded as a primary cause of death in only 55 cases. The total frequency of puerperal septicemia was the same as the frequency with which it appeared as a primary cause. This is due to the fact that according to the "Manual of Joint Causes of Death" it takes preference over any other puerperal cause. Consequently, it never appeared as a secondary cause.

A secondary cause was given on 531, or 77.1 percent, of the maternal death certificates. Of these more than one-half (280) were again puerperal causes. The most common nonpuerperal causes were diseases of the heart of which there were 76, and pneumonia which appeared on 47 certificates. Among the puerperal causes, cesarean operation appeared most frequently as a secondary cause of death (92

[6] This comes under International List number 141. The title "abortion without septic condition" is, in a sense, misleading since under this classification are coded also deaths of mothers of viable offspring when the cause of death is an accident of pregnancy.

deaths), followed by puerperal embolism and thrombosis which were given on 50 death certificates.

Secondary causes, largely nonpuerperal, were given in conjunction with accidents of childbirth more often than with any other cause. A nonpuerperal secondary cause was given in conjunction with accidents of childbirth more than twice as often as with the group of toxemias or with septicemia, and four times as frequently as in connection with the group classified as hemorrhage.

Interval between birth of child and death of mother.—From the statements on the birth certificate as to the date and time of birth and on the death certificate as to the date and time of death of the mother, it is possible to determine the length of time that elapsed between birth and maternal death.[7] Table 2 gives the distribution of the maternal deaths by interval between birth of child and death of mother. The distribution of the deaths during the first month by days and that of the deaths under 1 day by hours is shown in figure 1.

TABLE 2.—*Distribution of deaths of mothers of viable offspring by the interval between birth of child and death of mother—New York State (exclusive of New York City), 1936–38*

Interval between birth of child and death of mother	Deaths		Maternal deaths within 24 hours of birth of child			
	Number	Percent	Hours	Number of deaths	Percent of deaths under 1 day	Percent oi total deaths
Under 1 day	257	37.3	Prior to birth	24	9.3	3.5
1 day	40	5.8	Under 1 hour	30	15.2	5.7
2 days	36	5.2	1	28	10.9	4.1
3 days	37	5.4	2	29	11.3	4.2
4 days	32	4.6	3	29	11.3	4.2
5 days	32	4.6	4	17	6.6	2.5
6 days	29	4.2	5	8	3.1	1.2
7 days	26	3.8	6	15	5.8	2.2
8 days	17	2.5	7	13	5.1	1.9
9 days	12	1.7	8	7	2.7	1.0
10 days	13	1.9	9	8	3.1	1.2
11 days	13	1.9	10	1	0.4	0.1
12 days	13	1.9	11	3	1.2	0.4
13 days	11	1.6	12	8	3.1	1.2
2 weeks	34	4.9	13–16	12	4.7	1.7
3 weeks	26	3.8	17–20	9	3.5	1.3
1 month	44	6.4	21–23	5	1.9	0.7
2 months	17	2.5	Not stated	2	0.8	0.3
Total	689	100.0	Total	257	100.0	37.3
Under 1 week	463	67.2	0–6	189	73.5	27.4
Under 1 month	628	91.1	0–12	229	89.1	33.2

The average interval of time between birth of child and death of mother was 9.1 days. The first 24 hours after birth were the most fatal; 37 percent of all the deaths occurred within that interval. The mortality remained nearly constant for the next 3 days. There was a slight drop in the last 3 days of the first week and a sharper drop

[7] For the distribution of total maternal mortality by interval, see (2).

thereafter. Two out of every three deaths occurred within the first week after birth. Similarly, the first hour took the greatest toll of deaths under 1 day. The mortality was fairly constant for the next 3 hours and decreased markedly thereafter. In the first 12 hours occurred 89 percent of all the deaths under 1 day and a third of all maternal deaths. The rate of mortality in the second 12 hours of the first day remained the same for the following 3 days.

There were 24 women who, according to the statements of hour on the two certificates, appeared to have died prior to the birth of the infant. In the majority of these cases the interval was of only a few minutes' duration. In most of these cases the child was born dead. The longest period between death of mother and birth of infant was 55 minutes.

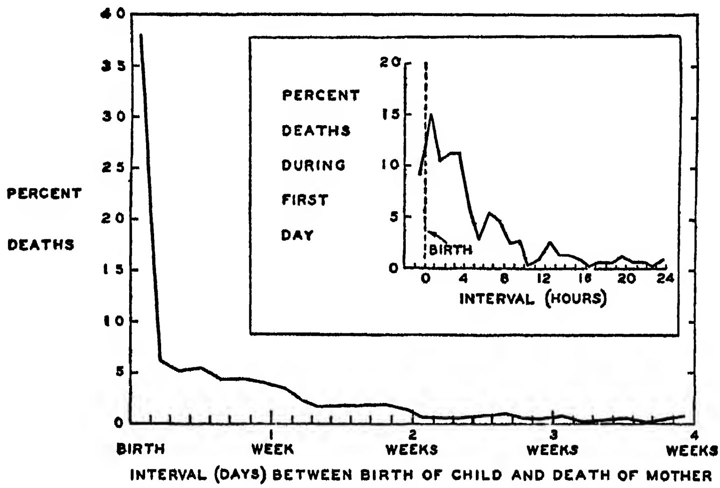

FIGURE 1.—Percentage distribution of puerperal deaths by interval between birth of child and death of mother. Deaths occurring in less than 1 month by daily interval and deaths occurring in less than 1 day by hourly interval, New York State, exclusive of New York City, 1936–38.

There were considerable differences in the average interval for the various causes of death, as may be seen from table 3 which gives the distribution of the deaths by cause and by interval between birth of child and death of mother.

Mothers dying from hemorrhage survived the shortest interval (2.2 days) and 73 percent of them died in less than 1 day. Mothers dying from septicemia had the longest interval (18.6 days), and only 2.5 percent of them died within 24 hours. The distribution by interval of septicemia deaths was different from the distribution of deaths from any other cause. These deaths were most numerous in the last 3 days of the first week after delivery. The average interval for mothers dying from toxemia was the same as that for mothers dying from accidents of childbirth (6.5 days).

TABLE 3.—*Distribution of puerperal deaths by cause of death and by interval between birth of child and death of mother—New York State (exclusive of New York City), 1936–38*

[Primary cause of death]

Interval between birth of child and death of mother	Total	Accidents of pregnancy, 141	Hemorrhage			Puerperal septicemia	Toxemia			Puerperal phlegmasia, etc., 148	Cesarean, 149a	Other accidents of childbirth, 149b	Unspecified conditions, 150
			144a	144b	Total	145, 140, 142a	146	147	Total				
Under 1 day	257	20	22	78	100	4	52	17	69	13	9	42	-------
Under 1 hour	63	6	6	7	13	1	14	6	20	3	3	17	-------
1 day	40	3	3	4	7	2	17	2	19	1	3	5	-------
2 days	36	4	1	4	5	3	9	3	12	4	6	2	-------
3 days	37	4	1	3	4	6	7	4	11	1	7	4	-------
4 days	32	3	-----	2	2	13	3	-----	3	-------	6	5	-------
5 days	32	1	1	1	2	12	5	1	6	1	5	5	-------
6 days	29	1	3	2	5	12	2	1	3	-------	6	2	-------
1 week	105	2	5	4	9	42	10	10	20	15	6	11	-------
2–3 weeks	60	-------	2	1	3	30	5	1	6	9	4	7	1
4 weeks and over	61	2	-----	-----	------	33	9	-----	9	9	3	4	1
Total	689	40	38	99	137	157	119	39	158	53	55	87	2
Under 1 day	37.3	50.0	57.9	78.8	73.0	2.5	43.6	43.6	43.7	24.5	16.4	48.3	-------
Under 1 hour	3.5	15.0	15.8	7.1	9.5	0.6	11.8	15.4	12.7	5.7	5.5	19.5	-------
1 day	5.8	7.5	7.9	4.0	5.1	1.3	14.3	5.1	12.0	1.9	5.4	5.7	-------
2 days	5.2	10.0	2.6	4.0	3.6	1.9	7.6	7.7	7.6	7.5	10.9	2.3	-------
3 days	5.4	10.0	2.6	3.0	2.9	3.8	5.9	10.3	7.0	1.9	12.7	4.6	-------
4 days	4.6	7.5	-----	2.0	1.5	8.3	2.5	-----	1.9	-------	10.9	5.7	-------
5 days	4.6	2.5	2.6	1.0	1.5	7.6	4.2	2.6	3.8	1.9	9.1	5.7	-------
6 days	4.3	2.5	7.9	2.0	3.6	7.6	1.7	2.6	1.9	-------	10.9	2.3	-------
1 week	15.2	5.0	13.2	4.0	6.6	26.7	8.4	25.6	12.7	28.3	10.9	12.6	-------
2–3 weeks	8.7	-------	5.3	1.0	2.2	19.1	4.2	2.6	3.8	17.0	7.3	8.0	-------
4 weeks and over	8.9	5.0	-----	-----	------	21.0	7.6	-----	5.7	27.0	5.4	4.5	-------
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-------
Average interval (in days)	9.1	4.2	3.7	1.6	2.2	18.6	7.2	4.4	6.5	15.2	8.1	6.5	-------

The largest proportion of mothers dying in less than 1 day died from hemorrhage. Toxemia of pregnancy was the most frequent cause when death occurred either in less than 1 hour or within 1 to 3 days after delivery, and from the fourth day on the largest number of deaths occurred from septicemia.

Puerperal fatality and survival of offspring.—Puerperal fatality is only one part of the casualties of childbirth. The other is that of the infant in the form of stillbirth or neonatal mortality.[8] The rate for each of these is over ten times as high as puerperal fatality. In many respects, the mortality of the mother is associated with that of the infant. The stillbirth and neonatal mortality rates of infants whose mothers die in childbirth is very much higher than those of infants whose mothers survive the postpartum period. Similarly, puerperal fatality increases sharply when the infant dies at birth or shortly thereafter.

[8] In this paper, neonatal mortality is used to indicate mortality of infants under 1 month of age.

Of the 258,525 infants in the study, 7,177 were stillbirths and 7,550 died neonatally. The stillbirth rate was 27.8 per 1,000 total births and the neonatal mortality rate was 30.0 per 1,000 live births. Thus, out of every 1,000 total births, 57 were either stillborn or did not live to be 1 month old. Among the 248,697 mothers who were delivered of live births, there occurred 479 deaths, and of the 7,030 mothers of stillbirths, 210 died. The puerperal fatality rate was 19.3 per 10,000 deliveries when the infant was born alive and 298.7 when the infant was born dead. The rate was 16.6 for mothers whose infants survived the neonatal period and 108.0 for mothers of infants who died neonatally. Similarly, the rate for combined loss[9] for infants of surviving[10] mothers was 56.0 per 1,000 total births, while for the infants of the 689 maternal deaths it was 417.4. The excess in the rate was more pronounced in the case of stillbirths than it was in the case of neonatal mortality. The respective rates for infants of surviving mothers and for those of mothers who died were 27.0 and 300.4 for stillbirths, and 29.8 and 167.3 for neonatal mortality. The increase in puerperal fatality associated with infant loss was greater than that in the rate for infant loss associated with death of mother. The ratio of puerperal fatality among mothers whose infants were lost to that of mothers of surviving infants was 12.2, while the ratio of the rate for combined infant loss[9] when the mother died in childbirth to that of infants whose mothers survived was 7.5. The ratios were 11.1 for stillbirth and 5.6 for neonatal mortality. These facts are brought out in figure 2 and table 4, which is a fourfold table presenting the outcome of pregnancy for mother and infant. From this table, it is possible to determine the probabilities of losing through puerperal fatality, stillbirths, and neonatal mortality mother only, infant only, and both mother and infant. In terms of chances per 10,000 deliveries these probabilities were:

	Chances per 10,000 deliveries
Losing infant only	558. 2
Losing mother only	15. 7
Losing both mother and infant	11. 3

The increase in puerperal fatality associated with loss of infant was present to a considerable degree in all causes of death, as may be seen from table 5. There were, however, notable differences in the relative frequencies of the various causes by outcome of pregnancy. Septicemia was the most common cause of death in the mothers who were delivered of live births, while toxemias of pregnancy were the largest group for the mothers of stillbirths. Accidents of childbirth were second in importance as a cause of death for mothers of live

[9] The term "combined loss" denotes the number of stillbirths and neonatal deaths combined per 1,000 total births.

[10] Mothers who did not die from a puerperal cause.

births, while puerperal hemorrhage was the second largest group for the mothers of the stillborn infants. The least frequent cause when the infant was born dead was cesarean operation, and the ratio of the mortality of mothers of stillbirths to that of mothers of live births was least for this cause. Similarly, septicemia and accidents of childbirth were, respectively, the first and second causes when the infant survived the neonatal period, while toxemia and septicemia had the corresponding respective roles for the mothers of the neonatal deaths.

TABLE 4.—*Distribution of births according to survival of mother and infant—New York State (exclusive of New York City), 1936–38*

Mother	Infant				Total	Rates for infant loss		
	Survived	Died				Combined loss [1]	Neonatal mortality [2]	Stillbirth [3]
		Total	Neonatal death	Stillbirth				
Survived	243,385	14,431	7,467	6,964	257,816	56.0	29.8	27.0
Died	413	296	83	213	709	417.4	167.3	300.4
Total	243,798	14,727	7,550	7,177	258,525	57.0	30.0	27.8
Puerperal fatality [4]	16.6	202.8	108.0	298.7	26.9			

[1] Per 1,000 total births (including stillbirths).
[2] Per 1,000 total live births.
[3] Per 1,000 total births (including stillbirths).
[4] Per 10,000 deliveries.

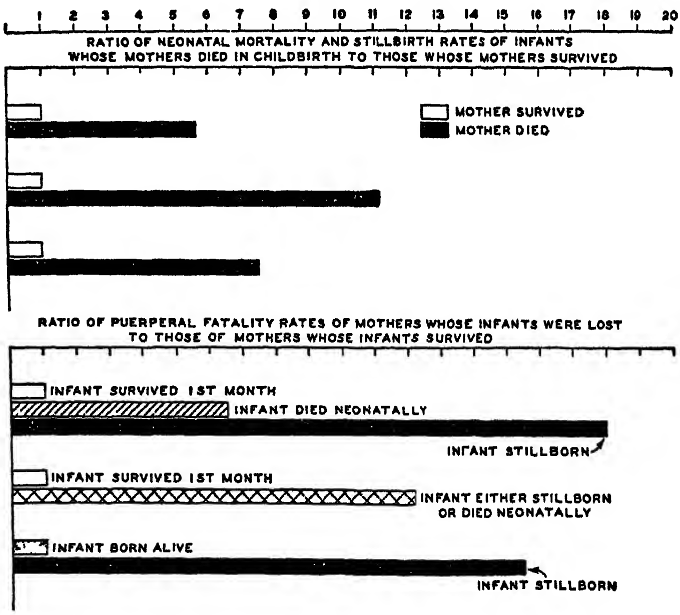

FIGURE 2.—Puerperal fatality in relation to survival of offspring and infant loss in relation to survival of mother, New York State, exclusive of New York City, 1936–38.

Of the infants whose mothers died, the largest proportion of survivors resulted from mothers who died from cesarean operation and the least number from those who died from accidents of pregnancy. Only 43.0 percent of the infants of mothers who died from toxemia survived the neonatal period. The corresponding percentage for the infants of the hemorrhage group was 56.2; for infants of mothers dying from septicemia the percentage was 68.8; and 73.9 percent of the infants whose mothers died from accidents of childbirth lived to be 1 month old.

TABLE 5.—*Puerperal fatality rates by cause of death and by survival of offspring—New York State (exclusive of New York City), 1936–38*

Cause of death	Number of maternal deaths: Total	Offspring: Live birth: Total	Offspring: Live birth: Survivor	Offspring: Live birth: Neonatal death	Offspring: Stillbirth	Puerperal fatality rates [1]: Total	Offspring: Live birth: Total	Offspring: Live birth: Survivor	Offspring: Live birth: Neonatal death	Offspring: Stillbirth	Offspring: Combined loss
Accidents of pregnancy	40	14	6	8	20	15.6	5.6	2.5	10.8	369.8	238.5
Puerperal hemorrhage	137	87	77	10	50	53.6	35.0	31.9	138.4	711.2	421.0
(a) Placenta praevia	38	20	16	4	18	14.9	8.0	6.6	55.4	256.0	154.4
(b) Other puerperal hemorrhages	90	67	61	6	32	38.7	26.9	25.3	83.1	455.2	266.6
Puerperal septicemia and pyemia (not specified as due to abortion)	157	131	108	23	26	61.4	52.7	44.7	318.4	369.8	343.8
Toxemias of pregnancy	158	92	68	24	66	61.8	37.0	28.2	332.3	938.8	631.4
Puerperal albuminuria and eclampsia	110	70	55	15	40	46.5	27.8	22.8	207.7	697.0	449.0
Other toxemias of pregnancy	39	22	13	9	17	15.3	8.8	5.4	124.6	241.8	182.4
Puerperal embolism and thrombosis (not specified as septic)	53	43	36	7	10	20.7	17.3	14.9	96.9	142.2	119.3
Other accidents of childbirth	142	110	105	5	32	55.5	44.2	43.5	69.2	455.2	259.6
(a) Cesarean operation	55	49	47	2	6	21.5	19.7	19.5	27.7	85.3	56.1
(b) Others	87	61	58	3	26	34.0	24.5	24.0	41.5	369.8	203.5
Other and unspecified conditions of the puerperal state	2	2	1	1	----	0.8	0.8	0.4	13.8	------	7.0
All puerperal causes	689	479	401	78	210	269.4	192.6	166.1	1,079.9	2,987.2	2,020.6

[1] Number of puerperal deaths per 100,000 deliveries in each category from each specified cause.

Parallel to the variations of cause of death by survival of offspring, there were notable differences in the length of the interval between birth of child and death of mother. The interval was considerably shorter for the mothers of stillbirths than it was for the mothers of live births, the respective intervals being 4.9 and 10.9 days. More than one-half of the deaths of mothers of stillbirths occurred within 24 hours of delivery, while only a third of the deaths of the mothers of live births occurred in this interval. The difference in the interval for the deaths of mothers whose infants survived the neonatal period and that of mothers whose infants died neonatally was considerably smaller. The average interval for the former was 11.2 days and for the latter it was 9.3 days.

Premature delivery.—The puerperal fatality as related to the period of gestation cannot be given in detail from the material at hand since the birth certificates until 1938 did not record the month of gestation. The only statement made was whether the child was full term or premature. Furthermore, since the weight and length of the infant are not given on the birth certificate, the statement by the physician that the birth was premature had to be accepted. However, the frequency of premature birth as obtained from the birth certificate agrees well with other studies in which the weight of the infant was taken as a criterion of prematurity (*10*). Furthermore, this information was available for two counties in the State in which special surveys were made and the known weight of the infant compared well with the statement of prematurity on the birth certificate.

Of the 255,727 deliveries, 13,727 were stated to be premature. The frequency of premature deliveries was therefore 53.7 per 1,000 total deliveries. The stillbirth and neonatal mortality rates of prematurely born infants is, as is known, very high. Of the 14,562 infants resulting from the premature deliveries, 3,608 were stillbirths and 4,095 were neonatal deaths. The stillbirth rate for the premature infants was 247.8 per 1,000 total premature births and the neonatal mortality rate was 373.8 per 1,000 premature live births. Thus, more than one-half of the prematurely born infants did not live to be 1 month old. The puerperal fatality associated with premature delivery was also considerably higher than that associated with full term deliveries. However, the increase in fatality associated with premature delivery is not as great for the mother as it is for the infant. Of the 242,000 mothers who delivered full term infants, 487 died in childbirth, and of the 13,727 mothers whose pregnancy terminated prematurely, 194 died. The respective puerperal fatality rates per 10,000 deliveries in the two groups were 20.1 and 141.3.

Table 6 presents the puerperal fatality rates by cause of death for full-term and premature births. The most frequent causes of death of the mothers who were delivered at term were septicemia and accidents of childbirth, while toxemias of pregnancy were by far the most frequent for the mothers whose pregnancy terminated prematurely. The puerperal fatality from cesarean operation was the same in the two groups.

As a probable result of the difference in causes of death, the interval between delivery and death was much longer for the full term maternal deaths (10.0 days) than for those in the premature group (6.1 days).

The increase in the puerperal fatality rates of premature deliveries was more pronounced for mothers of live births than for mothers of stillbirths. The respective rates in the full term and premature groups were 16.5 and 74.9 for the mothers of live births, and 266.2

and 318.7 among the mothers of stillbirths. The puerperal fatality among the mothers of neonatal deaths was the same whether the delivery was full term or premature. For mothers of infants who survived the neonatal period, the puerperal fatality rates in the full term and premature groups were 15.3 and 56.9, respectively.

TABLE 6.—*Puerperal fatality rates by cause of death for full term and premature deliveries—New York State (exclusive of New York City), 1936-38*

Cause of death	Number of deaths			Puerperal fatality rates [1]	
	Full term	Premature	Term not stated	Full term	Premature
Accidents of pregnancy	4	36	----------	1.7	262.3
Puerperal hemorrhage	109	27	1	45.0	196.7
(a) Placenta praevia	21	14	----------	9.9	102.0
(b) Other puerperal hemorrhages	85	13	1	35.1	94.7
Puerperal septicemia and pyemia (not specified as due to abortion)	128	25	4	52.9	182.1
Toxemias of pregnancy	75	82	1	31.0	597.4
(a) Puerperal albuminuria and eclampsia	57	62	----------	23.6	451.7
(b) Other toxemias of pregnancy	18	20	1	7.4	145.7
Puerperal embolism and thrombosis (not specified as septic)	42	11	--------	17.4	80.1
Other accidents of childbirth	127	13	2	52.5	94.7
(a) Cesarean operation	51	3	1	21.1	21.9
(b) Others	76	10	1	31.4	72.8
Other and unspecified conditions of the puerperal state	2	---------	----------	0.8	----------
Total	487	194	8	201.2	1413.3

[1] Number of puerperal deaths per 100,000 deliveries in each category from each specified cause.

Sex of infant.—The excess mortality of male infants over that of females is manifested also at birth. The stillbirth and neonatal mortality rates are considerably higher for boys than for girls. Of the 133,251 boys in this study, 3,914 were stillbirths and 4,422 died under 1 month of age. Among the 125,274 girls, there were 3,263 stillbirths and 3,128 neonatal deaths. The respective rates for boys and girls were 29.4 and 26.0 for stillbirths, and 34.2 and 25.6 for neonatal mortality. A priori considerations may lead to the expectation that puerperal fatality is also higher among mothers of boys than among mothers of girls. Boys are generally bigger and weigh more at birth and hence more complications may be expected. Furthermore, due to the higher stillbirth and neonatal mortality rates among boys, there are relatively more deliveries associated with loss of offspring among mothers of boys than among mothers of girls. Because of the association between survival of mother and offspring, higher puerperal fatality rates among mothers of boys might be expected to result from this fact alone. Actually no difference was noted in the total puerperal fatality rate by sex of offspring. The excess in the number of deliveries associated with the loss of male offspring was compensated by a relatively lower puerperal fatality

rate among the mothers of boys who were lost than among the mothers of girls who were born dead or who died neonatally.

There were 349 deaths among the mothers of boys and 334 deaths among mothers of girls.[11] The puerperal fatality rate was 26.2 for mothers of boys and 26.7 for mothers of girls.[12] Puerperal fatality was lower for mothers of boys than for mothers of girls when the infant died at birth or during the first month. The rates were 176.3 for mothers of boys and 217.5 for mothers of girls.[13] Among mothers whose infants survived the neonatal period, the fatality did not differ by sex of offspring. An increase in puerperal fatality was associated with female births both when the infant was stillborn and when it died during the first month. The respective rates for mothers of boys and girls were 275.9 and 306.5 in the case of stillbirths, and 86.2 and 124.7 in the case of neonatal deaths. Due to the relatively small number of deliveries available for study in each of these cases it is not possible to determine whether these differences are real or whether they arise from sampling variations. It would be of interest to investigate this point further on a larger sample of births.

Plural deliveries.—There were 2,776 plural deliveries during the 3-year period, resulting in 2,754 pairs of twins and 22 sets of triplets. The frequency of plural births was 10.9 per 1,000 deliveries. The total number of plural infants was 5,574. There were 21 deaths among the mothers of plural births, and the puerperal fatality rate for these mothers was 75.6, or nearly three times as high as the total puerperal fatality rate. This increase is of the same magnitude as the increase in total infant loss among plural births. The rate for combined loss among the plural births was 169.2. The stillbirth rate was 52.6 and the neonatal mortality rate was 123.1.

Of the 2,776 plural deliveries, 843 were of unlike-sexed and 1,933 were of like-sexed infants. In the first group there were 5 maternal deaths, and in the second group there were 16. The puerperal fatality rate was 59.3 for mothers of unlike-sexed and 82.8 for mothers of like-sexed plural births. Since the unlike-sexed twins are dizygotic while the like-sexed are a composite group consisting of both monozygotic and dizygotic, it is indicated that the puerperal fatality associated with the birth of monozygotic twins may be higher than that associated with the birth of dizygotic twins. The figures, however, are not large enough for safe conclusions.[14]

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[11] In addition, 5 maternal deaths were delivered of twins of different sexes and the sex of the infant of another maternal death was not stated

[12] These rates are based on births rather than on deliveries in order to avoid the complicating factor of unlike-sexed multiple deliveries Rates based on births differ only very slightly from those based on deliveries since multiple births form about one percent of all deliveries

[13] The difference in these rates is on the border line of statistical significance, being slightly less than twice the standard deviation of the difference

[14] The difference between the rates is not statistically significant.

Deaths of unwed mothers.—There were 5,764 unwed mothers in the study who were delivered of 5,812 infants. The frequency of illegitimate deliveries was 22.5 per 1,000. There were 15 maternal deaths in this group and the puerperal fatality rate was 26.0. This is practically the same as the fatality of legitimate deliveries. The infants of these mothers, however, did not fare as well. The stillbirth rate for illegitimate infants [15] was 60.0 and the neonatal mortality rate was 63.2. The rate for combined infant loss was 119.4. There may be an extra risk to the unwed mother which is hidden among the deaths associated with abortion. This, however, cannot be determined from the material at hand, since, as was stated previously, the population exposed to risk is not known. But it is of particular interest that among the unwed mothers in this study who were delivered of a viable infant, the puerperal fatality was not greater than that of the married mothers.

Residence of mother.—There were no differences in puerperal fatality between the mothers residing in urban localities and those living in the rural districts. The puerperal fatality rate was 26.9 for the former and 27.0 for the latter. Similarly, the chances of losing the infant were practically the same whether the mother resided in a city or in the country.

SUMMARY

This paper is the first of a series on puerperal fatality, which is defined as the risk of death to the mother associated with the delivery of a viable offspring. These studies will consider puerperal fatality in its relation to such factors as outcome of pregnancy (live birth, stillbirth, neonatal death), premature delivery, parity, age, sex of infant, number of previous infant losses, and so on. Puerperal fatality rates will be paralleled with the stillbirth and neonatal mortality rates.

The studies are based on over a quarter of a million deliveries and nearly 700 maternal deaths occurring in New York State (exclusive of New York City) in the 3-year period 1936–38. The information was obtained from routine vital statistics records of births and deaths.

The maternal death certificate was matched with the birth or stillbirth certificate of the infant. Similarly, the death certificate of infants who died under 1 month of age was matched with the birth certificate of the same infant. The information from the matched certificates was brought together on a single punch card.

This first paper records the following findings concerning puerperal fatality and loss of offspring:

1. The average interval between birth of child and death of mother was 9.1 days. The first 24 hours after delivery were the most fatal,

[15] Recent legislation in New York State forbids the mention of illegitimacy on the birth certificate. In the last 2 years of the study a child was considered illegitimate if the father's name was omitted from the birth certificate.

accounting for 37 percent of all deaths. Similarly, the first hour after the birth of the child took the greatest toll of the deaths under 1 day. Mothers dying from hemorrhage survived the shortest average interval (2.2 days); mothers dying from septicemia, the longest interval (18.6 days).

2. There was a strong association between death of mother and loss of offspring. The puerperal fatality rate was 19.3 per 10,000 deliveries when the infant was born alive and 298.7 when the infant was born dead. The rate was 16.6 for mothers whose infants survived the neonatal period and 108.0 for mothers whose infants died under 1 month of age. Similarly, the stillbirth rate was 27.0 per 1,000 total births for infants of surviving mothers and 300.4 for infants whose mothers died in childbirth. The corresponding neonatal mortality rates were 29.8 and 167.3 per 1,000 live births. Septicemia was the most frequent cause of death for mothers of live births, while toxemia was the most frequent cause for the mothers of stillbirths. The average interval between delivery and death was 10.9 days for mothers whose infants were born alive and 4.9 days for mothers of stillborn infants.

3. Mortality of both mother and infant increased sharply when pregnancy terminated prematurely. This increase was more pronounced for infants than for mothers. The puerperal fatality rate was 20.1 when birth was at term and 141.3 when it was premature. The stillbirth rate for premature infants was 247.8 and the neonatal mortality rate was 373.8. Septicemia was the most common cause of death for the mothers who went to term, while toxemia was by far the most frequent cause of death for the mothers of the premature. The increase in the puerperal fatality rate of premature births was more marked when the infant survived the neonatal period than when the infant was lost.

4. No difference was noted in the puerperal fatality rate by sex of infant, while the stillbirth and neonatal mortality rates were considerably higher for boys than for girls. The respective rates for males and females were 29.4 and 26.0 for stillbirths and 34.2 and 25.6 for neonatal mortality.

5. The puerperal fatality rate, as well as the stillbirth and neonatal mortality rates, of plural births were three times as high as the rates for single births.

6. Unwed mothers who were delivered of viable offspring were exposed to fatality rates which were practically the same as those of married mothers. The infants of the unmarried mothers, however, had higher mortality rates than legitimate infants. The stillbirth rate for illegitimate infants was 60.0 and the neonatal mortality rate was 63.2, compared to the total respective rates of 27.8 and 30.0.

7. The puerperal fatality rate, as well as the stillbirth and neonatal mortality rates, was the same whether the mother resided in an urban locality or in a rural district.

8. Use was made of the maternal deaths associated with abortion for the purpose of testing estimates on the frequency of abortions and on the mortality associated with this condition. It appears that, at least for New York State exclusive of New York City, the estimates are too high.

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LEPROSY: VITAMIN B_1 DEFICIENCY AND RAT LEPROSY

By L. F. Badger, *Surgeon*, E. Masunaga, *Laboratory Technician*, and D. Wolf, *Junior Bacteriologist, United States Public Health Service, Honolulu, Hawaii*

That there exists a relation between nutrition and leprosy has been believed by some investigators for many years and statements relative to such a relation have appeared in the literature with increasing frequency. Since we are unable to study human leprosy in laboratory animals, it is necessary to confine our nutritional studies to rat leprosy in the rat.

The results of some laboratory investigations of various nutritional deficiencies have been reported, of which but a few have dealt specifically with vitamin B_1 deficiencies while others have dealt with deficiencies in the vitamin B complex.

Muir and Henderson (*1*) in 1928 reported on a few studies of the relation of vitamin deficiency to rat leprosy and concluded that increased virulence of the infection does not occur in rats fed on vitamin deficient diets.

Lamb (*2*) in 1935 reported on his studies of the effects of malnutrition on the pathogenesis of rat leprosy, of which he made the following summary: "Subcutaneous inoculations of rat leproma in a large number of rats on many kinds of dietary deficiencies yielded generally negative results. * * * An exceptional case was a diet of starchy foods plus boiled taro root and fish, which repeatedly increased the development of subcutaneous lesions.

"Upon using intracardia inoculations of rat leproma, diets deficient in the vitamin B complex and somewhat low in protein produced an extensive increase in visceral lesions of rat leprosy * * *."

Badger and Sebrell (*3*) in 1935 in preliminary studies found that the incubation period of rat leprosy in white rats on a vitamin B_1 deficient diet was appreciably shorter than in the rats fed a well balanced diet.

Lampe and de Moor (*4*) in 1935 found that vitamin B_2 deficiency had some influence in aiding the development of rat leprosy after percutaneous inunction with moderate doses.

Lampe et al. (*5*) in 1936, in their report on infection of rats through the shaven skin from infected mud, stated that vitamin B_1 and B_2 hypovitaminosis appears to be necessary to produce the infection.

From the results of the investigations here reported, it may be stated that—

1. The incubation period of rat leprosy is of shorter duration in vitamin B_1 deficient than in normal rats.
2. After becoming established in rats inoculated subcutaneously, the leproma at the site of inoculation develops more rapidly and becomes much larger in the normal than in the vitamin B_1 deficient rats.
3. Gross evidence of generalization of the infection appears much earlier in the vitamin B_1 deficient than in the normal control rats.

Incubation period.—The duration of the incubation period can be determined with any degree of accuracy only following subcutaneous inoculation and only when the palpable foreign tissue reaction has completely disappeared. Because the palpable foreign tissue reaction persists in some of the deficient rats until after the true leproma becomes palpable, even following small doses of a dilute inoculum, it has been impossible in the majority of our experiments to determine accurately the period of incubation. In those experiments where the incubation period could be determined, it was definitely shorter in the vitamin B_1 deficient than in normal rats as illustrated in table 1.

Development of the leproma at the site of inoculation.—After it has become established, the leproma at the site of subcutaneous inocula-

tion develops more rapidly and becomes much larger in the normal, well nourished than in the vitamin B_1 deficient rats.

TABLE 1.—*Incubation period of rat leprosy following subcutaneous inoculation in vitamin B_1 deficient and normal rats. Percent of rats with palpable leproma*

Experiment No.	Group of rats	Number of rats	Percent of rats with palpable lepromata, after inoculation							
			First week	Second week	Third week	Fourth week	Fifth week	Sixth week	Seventh week	Eighth week
II	Vitamin B_1 deficient	25	0	40.0	68.0	100.0				
	Control	25	0	4.0	24.0	56.0	96.0	96.0	96.0	100.0
VIII	Vitamin B_1 deficient	24	0	0	8.3	20.1	50.0	87.5	95.8	100.0
	Control	24	0	0	4.1	8.3	33.3	79.1	95.8	100.0

To determine the size of the lepromata, each was measured in two dimensions. From these measurements the area involved and the average area of involvement in the rats of each group were determined. These measurements do not take into account the thickness of the lepromata which was much greater in the normal than in the deficient rats. A marked variation occurred in the size of the lepromata in the rats within the groups. After 6 to 8 months the lepromata in some of the deficient rats were larger in areas involved than in some of the control rats but they continued to remain thinner. Frequently in the deficient rats there was seen only a scar at the site of inoculation. More often they had the appearance of progressively spreading lesions, while those of the controls were more circumscribed until much later.

The differences in the size of the lepromata in the vitamin B_1 deficient and normal rats in some of the experiments are shown in table 2.

TABLE 2.—*Size of lepromata at the site of subcutaneous inoculation in vitamin B_1 deficient and normal rats*

Number of weeks after inoculation	Experiment No.	Group of rats	Number of rats	Measurements of lepromata in mm.	Area of lepromata in square mm.	
					Variation	Average size
8	XXII	Vitamin B_1 deficient	28	2 x 2 to 10 x 17	4 to 170	42.1
		Control	28	10 x 15 to 25 x 30	150 to 750	453.6
	XXV	Vitamin B_1 deficient	13	2 x 2 to 7 x 15	4 to 105	27.8
		Control	13	12 x 18 to 22 x 22	216 to 484	365.9
12	X	Vitamin B_1 deficient	10	2 x 2 to 15 x 17	4 to 255	92.6
		Control	10	10 x 20 to 27 x 30	200 to 810	431.1
16	X	Vitamin B_1 deficient	7	5 x 10 to 15 x 20	50 to 300	175.0
		Control	9	15 x 15 to 25 x 25	223 to 625	404.0
	XVI	Vitamin B_1 deficient	10	3 x 10 to 13 x 19	30 to 247	113.5
		Control	10	8 x 20 to 25 x 35	160 to 875	393.6
16–17	XL	Vitamin B_1 deficient	22	Scar to 17 x 17	0 to 289	116.6
		Control	22	7 x 10 to 23 x 30	70 to 690	314.6
20	XVI	Vitamin B_1 deficient	8	3 x 7 to 12 x 20	21 to 240	118.7
		Control	8	20 x 25 to 30 x 40	500 to 1,200	773.0
32	XVIII	Vitamin B_1 deficient	16	4 x 10 to 35 x 50	40 to 1,850	610.9
		Control	16	20 x 23 to 50 x 65	460 to 3,250	1,401.0

It is believed that the shorter incubation period and the smaller lepromata at the site of subcutaneous inoculation in the deficient rats were not due specifically to vitamin B_1 deficiency but to an interference with the cellular defense mechanism of the animal brought about by a poor state of nutrition.

The incubation period has been found to be in indirect proportion to the state of nutrition of the rat as signified by weight. In experiment II (table 1), 4 weeks after inoculation, 100 percent of the deficient rats had palpable lepromata while but 56 percent of the control rats had palpable lepromata. At that time each of the deficient rats weighed less than when placed on the diet and showed an average loss of 24.1 percent, while the control rats had gained an average of 185.2 percent. A group of rats deficient in vitamin B_2 was also studied in this experiment. Four weeks after inoculation 80 percent of this group of rats had palpable lepromata, and their average weight was 2 percent greater than when placed on the diet. In experiment VIII (table 1), 29.1 percent of the vitamin B_1 deficient rats, 4 weeks after inoculation, had palpable lepromata while but 8.3 percent of the control rats had palpable lepromata. At that time the average weight of the deficient rats was but 21.5 percent greater than when placed on the diet, while that of the control rats was 195.5 percent greater.

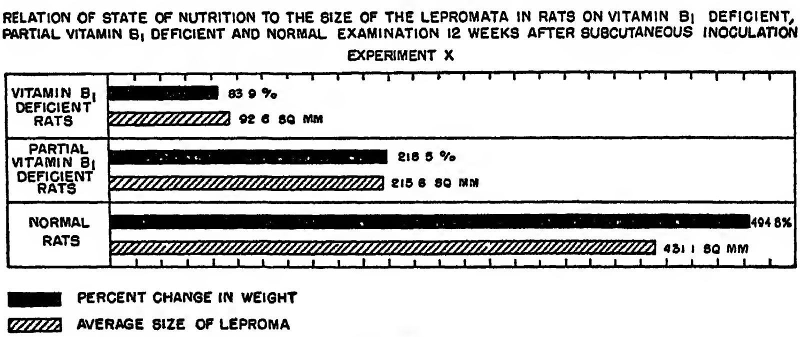

FIGURE 1.

The size of the leproma at the site of subcutaneous inoculation is in direct proportion to the state of nutrition of the rat as signified by the change in weight. This relation is well illustrated in the following two experiments and in figure 1.

In the first experiment vitamin B_1 deficient, partially vitamin B_1 deficient, and normal rats were studied. Twelve weeks after inoculation the average sizes of the lepromata of 10 rats of each group were 92.6, 215.6, and 431.1 sq. mm., respectively, while the average weights of the rats were 83.9, 281.5, and 494.8 percent greater than when placed on the diets.

In the second experiment rats malnourished by means other than vitamin deficiency were studied in addition to a vitamin B_1 deficient group. The state of malnutrition in one group was produced by limiting the food intake, in another by limiting the water intake, and in another by limiting the protein intake. Eight weeks after inoculation the average sizes of the lepromata of 13 rats of each group were: Vitamin B_1 deficient, 27.8 sq. mm.; low food intake, 79.9 sq. mm.; low water intake, 187 sq. mm.; low protein (4 percent casein), 241.6 sq. mm.; normal controls, 365.9 sq. mm. The average percentages of gain in weight of the rats examined were 3.7, 49.6, 66 6, 114.5, and 237.5, respectively (see figure 2).

RELATION OF STATE OF NUTRITION TO THE SIZE OF LEPROMATA IN RATS ON VITAMIN B_1 DEFICIENT, LOW FOOD INTAKE, LOW WATER INTAKE, LOW PROTEIN INTAKE AND CONTROL DIETS EXAMINATION 8 WEEKS AFTER SUBCUTANEOUS INOCULATION
EXPERIMENT XXV

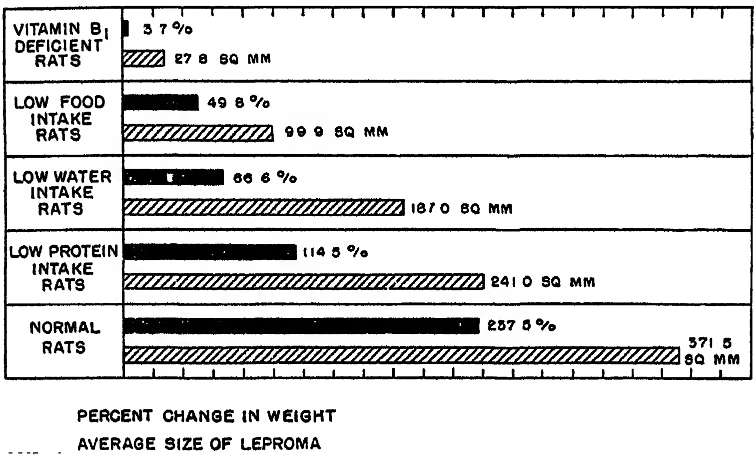

FIGURE 2.

The results obtained in several studies lend proof to the belief that these differences are due to an interference in the cellular defense mechanism in the poorly nourished animals.

The foreign-tissue reaction, resulting from subcutaneous inoculation, disappears more quickly in the well nourished than in the poorly nourished animals. Following subcutaneous inoculation a palpable foreign-tissue reaction may develop within 10 hours. The time of development of this reaction was determined in a group of rats Six hours after inoculation none of the rats had palpable lesions, in 10 hours a few had such lesions, and after 24 hours this reaction had developed in most of the rats. The size of this palpable foreign-tissue reaction and the rate of its disappearance, usually within 7 to 10 days in normal rats, are somewhat dependent on the concentration of the inoculum. The rate of disappearance of the palpable foreign-

tissue reaction in normal and malnourished rats is illustrated in table 3.

TABLE 3.—*Disappearance of the foreign tissue reaction following subcutaneous inoculation of leprosy material into vitamin B_1 deficient and well nourished rats; percent of rats with palpable reactions*

Experiment No.	Group of rats	Number of rats	Percent of rats with palpable reactions, after inoculation									
			First day	Second day	Third day	Fourth day	Fifth day	Sixth day	Seventh day	Eighth day	Ninth day	Tenth day
VI	Vitamin B_1 deficient	48	------	------	------	95 8	------	95 8	------	89 5	------	83 3
	Control	48	------	------	------	100 0	------	93 7	------	50 0	------	27.0
VIII	Vitamin B_1 deficient	24	------	------	87 5	------	50 0	------	28 1	------	------	8 3
	Control	24	------	------	87 5	------	45 8	------	20 8	------	------	0
X	Vitamin B_1 deficient	24	------	100 0	------	------	100 0	------	86 2	------	------	------
	Control	24	------	100 0	------	------	95 8	------	66 6	------	------	------
XVIII	Vitamin B_1 deficient	46	------	95 5	------	88 8	------	------	62.2	------	------	------
	Control	46	------	73 9	------	50 0	------	------	15 2	------	------	------
XXII	Vitamin B_1 deficient	40	95 0	------	90 0	------	52 5	------	15 0	------	------	------
	Control	40	87 5	------	50 0	------	17 5	------	12 5	------	------	------

To determine whether the difference in the rate of disappearance of the foreign-tissue reaction in poorly nourished and normal rats occurred only following inoculation of leprous tissue, in two experiments vitamin B_1 deficient and normal rats were inoculated subcutaneously with both normal subcutaneous and leprosy tissue, one under the left and the other under the right ventral surface. The foreign tissue reactions at the sites of both inoculations disappeared more quickly in the normal than in the malnourished rats.

An experiment was conducted to determine whether, by stimulating the cellular response to inoculation, the foreign-tissue reaction would disappear more rapidly and the lepromata develop more slowly. In the belief that an intravenous inoculation would produce a marked cellular response, a group of 29 rats was inoculated both intravenously and subcutaneously and another group of 29 subcutaneously only, with an emulsion of a rat leproma. The palpable foreign-tissue reaction disappeared much more quickly in the rats which received both the intravenous and subcutaneous inoculations than in the rats which received only the subcutaneous inoculation. The incubation period was much longer in the rats which received both the intravenous and subcutaneous inoculations than in the rats which received only the subcutaneous inoculation. The results of this experiment are shown in table 4.

To learn to what extent intravenous inoculation of leprous material produced a cellular response, a group of rats was so inoculated, and the change in the number of circulating white blood cells was

determined in a few. The average total numbers of white blood cells in the circulating blood of the rats studied were as follows: Previous to inoculation, 3,937; day after inoculation, 8,275; 2 days, 11,062; 3 days, 13,650; 5 days, 14,150; and 7 days, 16,200. After the seventh day the number gradually decreased.

TABLE 4.—*Disappearance of palpable foreign tissue reactions and the appearance of palpable lepromata in rats inoculated both subcutaneously and intravenously and in rats inoculated subcutaneouly only*

Disappearance of foreign tissue reaction			Appearance of palpable lepromata		
Number of days after inoculation	Percent with palpable reactions		Number of weeks after inoculation	Percent with palpable lepromata	
	Inoculated subcutaneously and intravenously	Inoculated subcutaneously only		Inoculated subcutaneously and intravenously	Inoculated subcutaneously only
1	----------	----------	1	0	0
2	75.9	96 0	2	0	0
3	----------	----------	3	0	0
4	----------	----------	4	0	10.3
5	0	3 5	5	3.4	27 5
6	----------	----------	6	10 3	58.6
7	----------	0	7	27 5	86 2
8	----------	----------	8	68.9	89.6

The results obtained from these studies suggest that the earlier disappearance of the palpable foreign-tissue reaction in the normal well nourished rats and the shorter incubation period in the malnourished rats are due to an interference with the cellular defense mechanism in the malnourished rats. Studies of the numbers of the white blood cells in the circulating blood of malnourished rats have been made to determine whether there has been an interference with the cellular defense mechanism in these rats.

In one experiment the total numbers of white cells in the circulating blood in 5 vitamin B_1 deficient and in 5 control rats were studied. These rats were 1 month old when placed on the experiment. During 15 days on the vitamin B_1 free diet the average number of white blood cells had increased from 5,890 to 8,090, while during the same period the average number in the rats on the control diet had increased from 6,100 to 9,060. It must be remembered that the rats on the vitamin B_1 free diet were but partially depleted during this period as it requires from 2 to 3 weeks to obtain complete depletion. Following subcutaneous inoculation of the deficient rats with an emulsion of a rat leproma there occurred practically no response to the inoculation as shown by the average number of white cells in the circulating blood 1, 2, and 3 weeks after inoculation. The counts were 6,930, 5,120, and 7,300, respectively, while in the control rats there occurred an increase of 50 percent from the time of inoculation to 3 weeks after inoculation.

The counts in the control rats were 9,700, 9,888, and 13,650, respectively.

In another experiment the numbers of white cells in the circulating blood were studied in 5 vitamin B_1 deficient and 5 control rats. These rats were 4 weeks old when placed on the experiment. The results were similar to those of the previous study. During the first 15 days on the vitamin B_1 free diet and before inoculation the average number of white cells had decreased from 8,630 to 7,720, while during the same period the average number in the control rats had increased from 7,400 to 12,210. During a period of 5 weeks following subcutaneous inoculation of an emulsion of a rat leproma the average number of white cells in the deficient rats remained approximately the same, 7,720 and 7,500, while the average number in the control rats had increased 38.5 percent, or from 12,210 to 16,920. From the onset of the experiment to 5 weeks after inoculation, a period of 7 weeks, a decrease of 43.9 percent occurred in the absolute number of lymphocytes in the deficient group and there was an increase of 101.9 percent in the control group of rats.

The results of these two studies suggest that the cellular defense mechanism of the rats is affected by vitamin B_1 deficiency. They particularly suggest that the deficiency affects the lymphocyte forming organs.

Another study showed that this effect on the numbers of white blood cells is not due particularly to the vitamin B_1 deficiency. Identical results were obtained in rats malnourished by means other than vitamin B_1 deficiency. The numbers of white cells in the circulating blood in 10 rats of each of the following groups were determined: (1) Vitamin B_1 deficient rats; (2) poor state of nutrition produced by limiting the intake of the normal control diet; (3) poor state of nutrition produced by limiting the intake of the normal control diet to which had been added 0.4 percent brewer's yeast and 0.2 percent cod-liver oil; and (4) normal control rats.

The average weekly weight of the rats on the three deficient diets was kept between 60 and 80 grams. The control rats gained in weight normally. The average white cell counts were similar in the three deficient groups of rats. During 70 days on the diets the changes that took place in the average numbers of white cells were as follows:

Total number of white blood cells:

Group 1.—Vitamin B_1 deficient, decrease of 30 percent.
Group 2.—Starvation, decrease of 36 percent.
Group 3.—Starvation plus vitamins, decrease of 35 percent.
Group 4.—Control, increase of 0.9 percent.

Absolute number of lymphocytes:

Group 1.—Vitamin B_1 deficient, decreased 37 percent.
Group 2.—Starvation, decreased 38 percent.
Group 3.—Starvation plus vitamins, decreased 34 percent.
Group 4.—Control, increased 5 percent.

Although blood cell counts were made on but few rats in each group, it is believed that they are of significance since the results on repetition were consistent. The studies were made on a total of 35 vitamin B_1 deficient, 30 starvation, and 40 control rats, all males of approximately the same age.

Histological examination made by Senior Pathologist G. L. Fite likewise suggests that vitamin B_1 deficiency interferes with the cellular defense mechanism of the animals. Such examinations were made of tissue from the sites of subcutaneous inoculation of vitamin B_1 deficient and control rats removed on the first, second, fourth, seventh, fourteenth, and twenty-first days after inoculation. It is particularly evident that the control animals displayed a much better response to the foreign tissues and much more rapid healing of the lesions. Thus, on the fourth day the control animals showed beginning fibrosis and organization of the inoculum, whereas the deficient animals showed none, and the lesions of these on the fourth day resembled closely those of the control animals on the second day. On the twenty-first day the control animals showed complete healing of the foreign tissue reaction by organization and fibrosis, while the deficient animals still showed a residue of the inoculum containing large numbers of bacilli. This seems to suggest that the bacilli proliferate well in the detritus of the inoculum in the deficient animals, whereas in the controls this foreign material is more rapidly and readily removed.

The leproma, a granuloma, is believed to be formed by the infiltration of cells and the development of fibrous tissue and is an attempt by the animal organism to overcome the infection. The well nourished animal is better able to attack the infective organism and build up a better defense, hence the larger lesions at the site of subcutaneous inoculation. In the malnourished animal the defense mechanism has been affected and is less able to attack the infecting organism, hence the smaller lesion at the site of subcutaneous inoculation.

From these studies it appears that the shorter incubation period and the smaller lepromata at the site of subcutaneous inoculation in the vitamin B_1 deficient rats were due to an interference with the cellular defense mechanism brought about by a state of general malnutrition and not specifically to vitamin B_1 deficiency.

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Gross evidence of generalization of the infection appears earlier in vitamin B_1 deficient than in the normal rats.—The infection was considered generalized when gross lesions were noted in the various organs of the body. Examinations were made either with the unaided eye or with a 6-power hand lens.

In rats receiving subcutaneous inoculations: Thirty-two weeks after subcutaneous inoculation 15 vitamin B_1 deficient and 15 control rats were killed and examined. Twelve, or 80 percent, of the 15 deficient animals had definite gross lesions of the liver and 4, or 26.6 percent, also had definite gross lesions of the spleen. None of the 15 control rats had lesions other than at the site of the subcutaneous inoculation. At this time no gross lesions were noted in any organs other than the liver and spleen.

Twenty days after the first examination, 8 months and 1 day after inoculation, 16 rats of each group were killed and examined. Eleven, or 68.7 percent, of the 16 deficient rats had gross evidence of a generalized infection, 4 had gross lesions of the skin, 11 of the liver, 6 of the spleen, 1 of the pericardium, 1 of the bony skeleton, and 2 had a generalized adenopathy. None of the 16 normal control rats had definite gross evidence of a generalized infection.

A comparison of the findings noted at the second examination with those noted at the first, 20 days intervening, is interesting. At the first examination the only lesions noted, signifying a generalized infection, were those of the liver and spleen, while at the second examination lesions were noted in the skin, pericardium, and bony skeleton.

Combining the findings observed at both examinations, gross evidence of a generalized infection was noted in 23, or 74.1 percent, of the 31 deficient rats, while none of the 31 well nourished control rats had such evidence.

A repetition of this experiment produced similar results. Nine months after subcutaneous inoculation 12 vitamin B_1 deficient and 12 normal rats were examined. Four, or 33.3 percent, of the deficient rats had definite gross lesions of the liver, and 2 of these also had gross lesions of the spleen. None of the 12 well nourished control rats had such lesions.

It will be noted that there were fewer rats in the second than in the first experiment with gross evidence of a generalized infection, although they were examined at approximately the same time after inoculation. It is not correct to compare the results in two experiments such as these, since it is impossible to determine the exact amount of infective material inoculated, which might be entirely different in the two experiments. However, in this instance the difference might be explained by the fact that the Hawaiian [1] strain of

[1] Isolated from a wild rat in Honolulu, Hawaii.

rat leprosy was employed in the first experiment and the Florida [2] strain in the second. The Hawaiian strain is apparently more virulent than the Florida strain.[3]

In rats receiving intraperitoneal inoculations: Following intraperitoneal inoculation the first lesions noted are those of the omentum.

Although the organisms early gain entrance to the lymph and blood streams and become disseminated throughout the animal, gross lesions in organs other than the omentum and mesentery are noted earlier in the vitamin B_1 deficient than in the control animals.

In the first experiment in which the rats were inoculated intraperitoneally, animals were examined at 8, 15, and 20 weeks after inoculation in order to determine at what time gross lesions developed in the various organs. Twelve rats from each group were examined 8 weeks after inoculation and 5 at 15 weeks. Lesions were noted only in the omentum and mesentery. Twenty weeks after inoculation 6 deficient and 7 control rats were living. On examination gross lesions were seen in the liver and spleen of each, and of the skin in 4 of the deficient animals, and in none of the control animals.

In a repetition of this experiment, 13 vitamin B_1 deficient and 13 control rats were examined 20 weeks after inoculation. Of the deficient rats, 46.1 percent had gross lesions of the skin, 84.6 percent of the spleen, and 100 percent of the liver. Of the normal rats, 53.8 percent had gross lesions of the spleen. None had gross lesions of the skin or liver. The lesions of the spleens of the deficient rats were more numerous and larger than those in the control rats.

Intraperitoneal inoculations were again repeated. Twenty weeks after inoculation 5 rats of each group were examined. Of the 5 vitamin B_1 deficient rats, 4 had gross lesions of the liver and 1 of the spleen, while none of the 5 controls had such lesions. Twenty-four weeks after inoculation, 3 of 4 deficient and none of 4 control animals had gross lesions of the abdominal organs. Six months after inoculation the rats remaining alive were examined. Seven of 9 deficient and none of 17 control rats had gross lesions of the liver or liver and spleen.

At the three examinations, 14, or 77.7 percent, of the total of 18 deficient rats had gross lesions of the liver or liver and spleen, while none of the 26 control rats had such lesions. At each examination the lesions of the omentum and mesentery were considerably larger in the deficient than in the normal control animals.

In the first experiment in which lesions were noted in the skin in addition to those in the liver and spleen, 20 weeks after inoculation, the Hawaiian strain of rat leprosy was employed, while in the third, in which no such lesions occurred, the Florida strain was employed.

[2] Isolated from a wild rat in Jacksonville, Fla.

[3] Bulletin 173, National Institute of Health, U. S. Public Health Service, 1940.

In rats receiving intravenous inoculations: Following intravenous inoculation the organisms are immediately spread throughout the animal tissues and the infection is generalized from the onset. However, definite gross lesions develop earlier in the vitamin B_1 deficient than in the normal rats.

Twenty-three vitamin B_1 deficient and 22 control rats were examined 16 weeks after intravenous inoculation. Of the 23 deficient rats, 22, or 95.6 percent, had gross lesions of the liver, while none of the 22 controls had such lesions. Lesions of the liver were the only ones noted at this time.

Intravenous inoculations were repeated. Sixteen weeks after inoculation, 20 vitamin B_1 deficient and 20 control rats were examined. Of the 20 deficient rats, 20, or 100 percent, had gross lesions of the liver and 2, or 10 percent, of the spleen. Of the 20 control rats, 8, or 40 percent, had gross lesions of the spleen or spleen and liver.

Six months after inoculation 14 of the control rats were living. Of these 14 rats, 8, or 57.1 percent, had gross lesions of the liver, 13, or 92.8 percent, of the spleen, and 14, or 100 percent, of either the liver or spleen or both organs. Thus, at 16 weeks 100 percent of the deficient rats had gross lesions of the liver or liver and spleen, while but 40 percent of the control rats had such lesions. At 6 months 100 percent of the control rats had such lesions.

The results of these two experiments and those of several subsequent experiments, in which the inoculations were made by the intravenous route, are tabulated in table 5.

In rats receiving intranasal instillations: Four weeks following intranasal instillation smears prepared by crushing cervical lymph glands of 16 vitamin B_1 deficient and 9 control rats, when examined, revealed no acid-fast organisms.

Smears similarly prepared with cervical glands of 21 vitamin B_1 deficient and 15 control rats were examined 8 weeks after instillation. Acid-fast organisms were observed in 19, or 90.4 percent, of the smears prepared from the glands of the deficient rats and in 9, or 60 percent, of those prepared from the normal or control rats.

Approximately 10 weeks after instillation acid-fast organisms were demonstrated in smears prepared with cervical lymph glands of each of 8 vitamin B_1 deficient rats and in but 50 percent of the smears similarly prepared from 8 control rats.

Nine months after instillation 8 of the vitamin B_1 deficient and 6 normal control rats were examined for gross evidences of generalization of the infection. Of the 8 deficient rats, 6, or 75 percent, had extension into the periglandular tissues of the cervical region; 2, or 25 percent, had generalized adenopathy; 6, or 75 percent, had gross lesions of the liver; 4, or 40 percent, of the spleen; and 1, or 12.5

percent, of the skin. In none of the 8 control rats was there noted any gross evidence of generalization of the infection.

From these experiments it can be definitely stated that gross evidence of a generalized infection appears earlier in the vitamin B_1 deficient than in the normal control rats.

In the course of these experiments it was thought advisable to study the relation of calcium deficiency to rat leprosy.[4]

TABLE 5.—*Gross evidence of a generalized infection in vitamin B_1 deficient and normal rats*

Mode of inoculation	Experiment No.	Number of weeks after inoculation	Group of rats	Number of rats	Number and percent of rats showing gross lesions of the liver, spleen, or skin: Liver	Spleen	Skin	Total rats with gross evidence of generalized infection
Subcutaneous	XVIII	32 to 35	Vitamin B_1 deficient.	31	23 or 74.1 percent.	10 or 32.2 percent	4 or 12.9 percent	23 or 74.1 percent.
			Control	31	None	None	None	None.
	XXVIII	39	Vitamin B_1 deficient.	12	4 or 33.3 percent.	2 or 16.6 percent.	None	4 or 33.3 percent.
			Control	12	None	None	None	None.
Intraperitoneal	V	20	Vitamin B_1 deficient.	6	6 or 100.0 percent	6 or 100.0 percent.	4 or 66.6 percent.	6 or 100.0 percent.
			Control	7	None	None	None	None.
	XV	20	Vitamin B_1 deficient.	13	13 or 100.0 percent.	11 or 84.6 percent.	6 or 46.1 percent.	13 or 100.0 percent.
			Control	13	None	7 or 53.8 percent.	None	7 or 53.8 percent.
	XXX	27	Vitamin B_1 deficient.	9	7 or 77.7 percent.	4 or 44.4 percent.	None	8 or 88.8 percent
			Control	17	None	None	None	None.
Intravenous	XXI	15	Vitamin B_1 deficient.	23	22 or 95.6 percent	None	None	22 or 95.6 percent.
			Control	22	None	None	None	None.
	XXXI	16	Vitamin B_1 deficient.	20	20 or 100.0 percent	2 or 10 percent.	None	20 or 100.0 percent.
			Control	20	6 or 30.0 percent.	2 or 10 percent.	None	8 or 40.0 percent.
	XL	16 to 17	Vitamin B_1 deficient.	22	20 or 90.9 percent.	3 or 13.6 percent.	None	20 or 90.9 percent.
			Control	22	None	None	None	None.
Intranasal	XII	40	Vitamin B_1 deficient.	8	6 or 75.0 percent.	6 or 75.0 percent.	2 or 25 percent.	6 or 75.0 percent.
			Control	8	None	None	None	None.

In the first experiment 3 groups of 34 rats each were studied: Vitamin B_1 deficient, calcium deficient, and normal control. Examinations were made 17 weeks after inoculation. Of 22 rats of the vitamin B_1 deficient and calcium deficient groups, 90.9 percent had gross evidence of generalization of the infection and none of 22 controls had evidence of such infection.

In another experiment calcium deficient rats were again studied. Examinations were made at approximately 17 weeks after inoculation, at which time 100 percent of 16 calcium deficient rats and 6.2 percent of 26 control rats had gross evidence of generalization of the infection.

[4] In the remaining experiments intravenous inoculations only have been employed.

The results of these two experiments suggest that calcium deficient rats are as susceptible to rat leprosy as are vitamin B_1 deficient rats. The questions arose: Is the increased susceptibility of the vitamin B_1 deficient rats due specifically to a deficiency in that vitamin, and that of the calcium deficient specifically to a deficiency in that element or is there a factor common to both which produces the increased susceptibility?

To answer these questions experiments were conducted, the results of which have been reported (*6*). The rats maintained on the vitamin B_1 deficient diet were not found to be deficient in calcium, as shown by chemical analysis of the tails. The rats maintained on the calcium deficient diet were found to be deficient in vitamin B_1, as shown by the determinations of the amount of that vitamin in the blood. The administration of vitamin B_1 to both groups, those maintained on the vitamin B_1 deficient and those maintained on the calcium deficient diet, caused them to be no more susceptible to the infection than the normal control rats. These findings strongly suggest that the increased susceptibility is due to vitamin B_1 deficiency and not to calcium deficiency and that, for some reason as yet undetermined, the rats maintained on the calcium deficient diet are incapable of utilizing the vitamin B_1 available in the diet. Evidence has been obtained which suggests that the calcium deficient diet employed is also deficient in some other factor or factors.

SUMMARY AND CONCLUSIONS

The incubation period of rat leprosy in rats maintained on a vitamin B_1 free diet is definitely shorter than in rats maintained on a normal control diet. Evidence has been obtained which suggests that the shortened incubation period is due to an interference with the cellular defense mechanism of the animal rather than specifically to the vitamin deficiency.

Rats maintained on a vitamin B_1 deficient diet are definitely more susceptible to rat leprosy than are normal rats. The criteria for susceptibility employed have been the development of gross evidence of generalization of the infection. Evidence has been obtained which suggests that the increased susceptibility is due specifically to the vitamin B_1 deficiency. Rats maintained on the deficient diet which received purified vitamin B_1 as a supplement are no more susceptible than are normal rats.

Rats maintained on a calcium deficient diet are approximately as susceptible as those maintained on the vitamin B_1 free diet. Evidence has been obtained which has shown the rats maintained on the calcium deficient diet to be deficient also in vitamin B_1 through the inability to utilize the vitamin B_1 available in the diet. The amount of vitamin B_1 in the circulating blood of the rats maintained on the calcium

deficient diet is approximately the same as that of the rats maintained on the vitamin B_1 free diet. Rats maintained on the calcium deficient diet which receive purified B_1 as a supplement are no more susceptible than are normal rats.

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CHRONIC MANGANESE POISONING

A Review

In 1937 several patients with an obscure, disabling, neurologic disease were studied in the University of Pennsylvania Hospital and were found to have chronic manganese poisoning. The processers of manganese ore at the mill at which these men had been employed as laborers requested the Public Health Service to study the health hazards in that industry in the hope that the cause of several cases of manganese poisoning among the employees might be ascertained, and that preventive measures might be instituted to obviate the further occurrence of this disease. Accordingly, in August 1937 the Public Health Service in cooperation with the Division of Industrial Hygiene of the Pennsylvania Department of Health began medical, engineering, and chemical studies in two manganese-ore-crushing mills to determine, among other things, the concentration of manganese dusts in the air at the breathing level in all parts of the plant where men work. The report of these investigations has been published recently as Public Health Bulletin No. 247.[1] One of these mills had been in operation about 20 years and in this mill little attempt had been made to prevent the dispersal of dust. The highest manganese con-

[1] Public Health Bulletin No 247, Chronic Manganese Poisoning in an Ore-Crushing Mill, by Robert H. Flinn, Paul A. Neal, Warren H. Reinhart, J. M. DallaValle, William B. Fulton, and Allan E Dooley. This report contains a chapter by J. W. Miller, reporting post-mortem findings in a case of manganese poisoning, and a chapter by Lawrence T. Fairhall, concerning chemical analysis of the manganese content of the blood. The report contains a description of the sources and uses of manganese, manufacturing methods, results of engineering and medical studies, and detailed case histories of 6 of the 11 reported cases of manganese poisoning. There is an annotated bibliography of 42 titles and an analytical index. The Bulletin contains 77 pages. It is available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15¢ per copy.

centrations were found in the vicinity of the pulverizer, where the average manganese concentration amounted to 173 mg. of manganese per cubic meter. In a newly completed plant, the machinery was enclosed, ore was transported from place to place by a crane or on conveyor belts, and exhaust ventilation was applied at strategic points. The dustiest operation in the latter plant, filling bags or barrels, exposed the operators to 6 mg. per cubic meter, and the average exposure throughout the plant was little more than 2 mg. per cubic meter.

Chronic manganese poisoning was the principal disease found on medical examination of 34 men employed, or formerly employed, in the older of these two plants. Eleven cases of this disease were found. The prevalence of the disease depended on the amount of manganese in the workroom air and on the duration of employment. No cases were found among men exposed to less than 30 mg. of manganese per cubic meter, but this should not be considered as a threshold limit because only a few men were so exposed, and some exposures were intermittent. Five of the 6 men exposed for more than 3 years to concentrations in excess of 90 mg. per cubic meter had chronic manganese poisoning. In one man, manganese poisoning developed after 10 months' exposure to 30 mg. per cubic meter, and in another case, after a year's exposure to 50 mg. of manganese per cubic meter.

The disease is characterized by muscular stiffness and incoordination which progresses until disability results. It is usually first apparent as disturbances in gait and difficulty in stepping backward without falling down, speech disturbances, including stuttering and running together of words, muscular twitchings or tremors, and occasionally a masklike facial expression. The worker often complains of extreme drowsiness, weakness, or lassitude, muscular twitchings and cramps, and difficulty in walking and talking.

Chemical analysis of viscera obtained at post-mortem examination from one of these cases of manganese poisoning showed 3.07 and 4.87 mg. of manganese per 100 g. of dry tissue in the right and left lung, respectively, and very much smaller amounts in the other organs, indicating that the patient still had a reservoir of manganese in the lungs 7 years after his last exposure to this dust. Also, a few months before death he had been found to be excreting small amounts of manganese in the urine.

Extensive laboratory examinations of these workers indicated that a low white-cell count with a decreased percentage of neutrophils, a slightly lowered blood calcium content, and a slight reduction in the middle zone of Lange's test were often associated with manganese poisoning. A lowered hemoglobin content was observed in several of the manganese workers. Analysis of the blood for manganese content was of no assistance in this study. Urinary manganese appears to reflect a present or past exposure to manganese compounds rather

than evidence of intoxication. Impairment of kidney or liver function was not observed.

The differential diagnosis of this disease, which has many features in common with multiple sclerosis, paralysis agitans, and progressive lenticular degeneration, has been discussed in this bulletin.

The control methods which have come into general use in other dusty trades, namely, enclosed processes, mechanical conveyors, and exhaust ventilation, have been tested and were found to be effective in preventing the dispersal of manganese dusts. To supplement this medical examinations, made quarterly, should make it possible to detect early cases of manganese poisoning, to permit their transfer to nondusty occupations, and to direct attention to faulty control methods. Especial attention should be given to complaints of general weakness, drowsiness, and muscular twitchings and cramps. Disorders in gait and speech or the occurrence of tremor suggest the onset of this disease. White blood cell counts may well be made, as it seems that a reduction in these values is associated with manganese poisoning, although it is not known whether these findings precede the development of physical findings. Inasmuch as disability resulting from well-advanced stages of manganese poisoning is permanent, every effort should be made to detect and transfer workers away from a hazardous exposure at the onset of the disease until the manganese hazard has been controlled.

PSITTACOSIS CASE IN IDAHO TRACED TO SHELL PARAKEETS SHIPPED FROM SOUTHERN CALIFORNIA AVIARY

According to information received under date of May 14, from Dr. W. M. Dickie, Director of Public Health of California, the source of infection in the fatal human case of psittacosis which occurred in Caldwell, Idaho, in December 1939, was shell parakeets from a pet shop in Los Angeles, Calif.

Investigation has revealed that a pair of shell parakeets had been purchased by the deceased in the latter part of November from a local dealer in Caldwell, Idaho, whose only stock of parakeets was a shipment of 24 birds received earlier in the month from a pet shop in Los Angeles. The purchaser became ill on December 5 and died on December 18. Psittacosis infection was subsequently proved in the birds purchased by the deceased and in the remaining birds held by the Caldwell dealer. The infection was also proved in several shell parakeets and other psittacine birds in the Los Angeles pet shop.

As no infection was found in the local breeding aviaries which supplied the California dealer, and as this dealer had imported from other countries larger psittacine birds, several shipments of which had been found to be infected, it is probable that the infection was introduced into the Los Angeles pet shop by imported birds.

Under the direction and supervision of representatives of the California State Department of Health and the Los Angeles County Health Department, all psittacine birds of the Los Angeles pet shop were destroyed and the premises were cleaned, disinfected, and remodeled.

Birds from the same Los Angeles pet shop were apparently involved in an outbreak of 3 cases of psittacosis in Tucson, Ariz., in October and November 1939.[1] Two cases occurred in young adults of the same family and 1 case in a nurse who cared for the two patients.

The family owned 2 lovebirds, purchased from a local dealer in July 1938,[2] which had been procured from the Los Angeles pet shop in question in April 1938.[2] When psittacosis was suggested, the birds were set free and were therefore not available for examination; but examination of the other birds of the same group in possession of the local dealer is stated to have been negative. During 7 weeks in the summer of 1939 the two lovebirds had been cared for by a family which owned 6 canaries; it was stated that these canaries had shown no evidence of illness and that the canaries and lovebirds were kept in separate rooms. The lovebirds were returned to the owner about September 15, 1939. The source of the infection in the two lovebirds was not determined.

In this connection, it is of interest to note that, in an outbreak of psittacosis in Pasadena, Calif., some years ago, it was reported that one case was traced to canaries which had shown no evidence of illness, but when killed and examined were found to be infected.

COURT DECISION ON PUBLIC HEALTH

City ordinance pertaining to public market places upheld.—(Florida Supreme Court; *McCroan* v. *Bloodworth, Chief of Police, et al.*, 193 So. 431; decided January 23, 1940.) An ordinance of the city of Apalachicola provided, in section 1, for the designation, when deemed practicable, of parts of city streets as public market places for the sale of meat, fruit, vegetables, or other foodstuffs and for the allotting to each permittee of one uniform space or more as required, each space to be sufficient to accommodate one truck or automobile. The remainder of the ordinance dealt with the securing and revocation of, and fees for, permits; the inspection of foodstuffs; the prohibition of the sale of unwholesome foodstuffs; and the prohibition, except as otherwise expressly provided, of the sale of foodstuffs at other than the allotted spaces.

[1] Public Health Reports, Jan. 12, 1940, p. 99.

[2] First report (Dec. 27, 1939) from Dr. J. D. Dunshee, of the Arizona State Board of Health, stated the birds had been purchased by the local dealer in April 1939, while a later report (Jan. 9, 1940) gives the dates of purchase and resale as here recorded.

In habeas corpus proceedings the petitioner challenged the provisions of the ordinance with the exception of section 1, but the supreme court said that it appeared that the provisions complained of were authorized by the city charter act and did not violate any provisions of the State constitution or statutes. The court further stated that the provisions came within the purview of the State police power and were properly declared to be for the protection of the health and welfare of the people of the city.

DEATHS DURING WEEK ENDED MAY 25, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended May 25, 1940	Corresponding week, 1939
Data from 88 large cities of the United States		
Total deaths	8,280	8,019
Average for 3 prior years	8,232	
Total deaths, first 21 weeks of year	191,991	191,396
Deaths under 1 year of age	490	491
Average for 3 prior years	504	
Deaths under 1 year of age, first 21 weeks of year	10,705	11,206
Data from industrial insurance companies		
Policies in force	65,481,168	67,244,634
Number of death claims	12,309	12,089
Death claims per 1,000 policies in force, annual rate	9.8	9.8
Death claims per 1,000 policies, first 21 weeks of year, annual rate	10.5	11.6

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JUNE 1, 1940

Summary

The incidence of each of the 9 communicable diseases included in the weekly telegraphic reports published in the following table, with the exception of poliomyelitis and typhoid fever, showed a decrease as compared with the preceding week and, with the exception of influenza and poliomyelitis, was below the 5-year (1935–39) median expectancy. The accumulative total to date for each of these diseases, except influenza and poliomyelitis, is also below the 5-year cumulative median.

Of the 47 cases of poliomyelitis reported for the current week, 35 cases occurred in the 3 Pacific States—Washington 25 cases (all in Pierce county, 13 in Tacoma), California 9 (5 in Los Angeles), and 1 case in Oregon. During the preceding week Washington reported 10 cases, and the week before that 7 cases. Since the first of the year, a total of 544 cases of poliomyelitis has been reported in the United States, of which 163 cases occurred in the 3 Pacific States (112 cases in California).

During the current week, 147 cases of typhoid fever were reported (20 cases in Tennessee, 11 in Georgia, and 10 in Missouri), as compared with 141 cases for the preceding week. The current incidence for the country as a whole, however, is below the 5-year median expectancy of 197 cases.

Of 18 cases of Rocky Mountain spotted fever reported currently, 2 cases occurred in Maryland and 1 case in Virginia. The other cases were reported from the northwestern States.

Sixteen cases of endemic typhus fever were reported from the South Atlantic and South Central States.

For the current week the Bureau of the Census reports 7,682 deaths in 88 major cities of the United States, as compared with 8,280 for the preceding week and with a 3-year (1937–39) average of 8,232 for the corresponding week.

Telegraphic morbidity reports from State health officers for the week ended June 1, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	June 1, 1940	June 3, 1939		June 1, 1940	June 3, 1939		June 1, 1940	June 3, 1939		June 1, 1940	June 3, 1939	
NEW ENG.												
Maine	0	0	0	------	------	------	344	70	105	0	0	0
New Hampshire	0	0	0	------	------	------	11	5	8	0	0	0
Vermont	0	0	0	------	------	------	2	130	79	0	0	0
Massachusetts	3	2	3	------	------	------	1,185	976	617	1	2	3
Rhode Island	0	0	0	------	------	------	193	136	81	0	0	0
Connecticut	0	0	2	1	1	1	26	570	203	0	0	0
MID. ATL.												
New York	15	20	28	[1] 6	[1] 6	[1] 6	919	2,150	2,430	1	5	6
New Jersey	4	12	9	4	------	5	990	36	724	0	2	2
Pennsylvania	14	17	21	------	------	------	451	87	1,846	2	18	9
E. NO. CEN.												
Ohio	8	15	21	38	13	22	43	96	1,491	1	3	5
Indiana	5	4	7	4	1	9	22	10	215	0	0	0
Illinois	13	23	32	18	8	15	103	35	454	1	4	4
Michigan [2]	1	8	7	11	4	2	610	403	403	2	0	2
Wisconsin	2	2	2	19	35	27	1,005	743	743	0	0	0
W. NO. CEN.												
Minnesota	1	2	4	1	2	1	46	216	270	0	0	0
Iowa	1	3	2	------	2	2	145	188	188	0	1	0
Missouri	2	3	11	1	------	36	53	4	71	0	0	2
North Dakota	1	0	0	------	47	6	5	14	14	1	0	0
South Dakota	0	0	1	------	8	------	0	196	4	0	0	0
Nebraska	6	0	2	------	6	1	17	160	160	1	0	0
Kansas	1	0	3	1	5	------	407	58	58	0	0	0
SO. ATL.												
Delaware	0	0	0	------	------	------	1	36	17	0	0	0
Maryland [2, 3]	1	2	3	1	6	2	4	129	120	0	1	1
Dist. of Col.	3	4	6	------	------	1	2	334	110	0	0	2
Virginia [3]	3	15	10	48	87	------	227	999	380	1	0	2
West Virginia [2]	3	7	7	5	4	11	15	7	59	1	1	3
North Carolina	8	7	7	6	1	1	157	459	309	0	0	3
South Carolina [4]	9	3	2	128	188	77	20	15	64	1	3	1
Georgia [4]	3	7	3	14	51	------	73	106	0	1	0	0
Florida [4]	6	3	4	------	18	3	116	73	20	0	0	1
E. SO. CEN.												
Kentucky	2	4	4	40	2	3	79	11	105	0	0	5
Tennessee	3	3	3	10	20	20	153	82	82	0	1	3
Alabama [4]	4	3	10	14	32	27	89	148	103	3	3	3
Mississippi [2]	3	8	5	------	------	------	------	------	0	0	0	0
W. SO. CEN.												
Arkansas	3	2	3	6	48	28	108	28	28	0	1	0
Louisiana [4]	5	10	8	19	4	4	3	79	32	1	0	0
Oklahoma [4]	3	2	8	10	22	25	15	100	49	1	0	0
Texas [4]	15	10	32	121	80	100	1,058	420	280	0	1	3
MOUNTAIN												
Montana [3]	0	0	0	6	3	------	31	124	90	0	1	1
Idaho [3]	0	1	0	------	------	------	37	55	16	0	0	0
Wyoming [3]	0	1	0	------	------	------	24	26	16	1	0	0
Colorado [3, 5]	9	6	6	8	7	------	43	151	151	0	0	0
New Mexico	1	0	1	------	1	1	56	14	16	0	0	0
Arizona	2	0	1	40	27	21	35	13	33	0	0	0
Utah [2, 3]	0	2	0	------	1	------	479	86	80	0	0	0
PACIFIC												
Washington	1	5	1	------	------	------	320	777	339	0	0	0
Oregon [3]	4	0	0	5	24	15	345	71	74	0	0	1
California	15	20	21	19	34	34	354	2,085	1,281	0	2	2
Total	183	236	339	622	804	570	10,484	12,783	14,160	20	49	96
22 weeks	7,032	9,267	11,032	164,674	147,113	136,400	172,434	301,185	301,185	808	1,052	3,134

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 1, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	June 1, 1940	June 3, 1939		June 1, 1940	June 3, 1939		June 1, 1940	June 3, 1939		June 1, 1940	June 3, 1939	
NEW ENG.												
Maine	0	0	0	10	4	10	0	0	0	0	0	1
New Hampshire	0	0	0	1	5	20	0	0	0	0	0	0
Vermont	0	0	0	2	12	6	0	0	0	0	0	0
Massachusetts	0	0	0	101	138	217	0	0	0	4	0	1
Rhode Island	0	0	0	4	8	23	0	0	0	0	0	0
Connecticut	0	1	0	52	85	73	0	0	0	4	1	2
MID. ATL.												
New York	0	2	1	661	362	566	0	20	0	4	6	6
New Jersey	0	1	0	284	119	131	0	0	0	2	3	2
Pennsylvania	1	0	0	271	194	338	0	0	0	9	7	7
E. NO. CEN.												
Ohio	2	0	0	369	267	267	0	28	2	9	16	7
Indiana	0	0	0	87	78	88	1	22	22	5	1	1
Illinois	0	2	0	650	277	401	9	10	15	2	7	6
Michigan [2]	0	0	0	238	262	271	0	7	1	0	1	5
Wisconsin	0	1	0	109	103	207	3	1	2	1	1	1
W. NO. CEN.												
Minnesota	0	0	0	55	70	117	7	17	16	0	1	1
Iowa	1	0	0	22	45	68	8	30	22	0	2	0
Missouri	0	0	0	38	41	91	0	28	28	10	1	8
North Dakota	0	0	0	2	2	23	0	0	11	4	4	2
South Dakota	0	0	0	2	15	15	1	14	14	2	0	0
Nebraska	0	0	0	6	4	38	1	9	9	0	0	0
Kansas	0	0	0	42	38	57	1	6	13	2	0	1
SO. ATL.												
Delaware	0	0	0	2	5	3	0	0	0	0	0	0
Maryland [2] [3]	0	0	0	33	15	38	0	0	0	1	2	4
Dist. of Col.	0	0	0	20	7	11	0	0	0	1	1	1
Virginia [3]	0	0	0	36	19	20	0	0	0	0	6	7
West Virginia [3]	0	0	1	20	26	40	0	0	0	3	6	5
North Carolina	0	1	2	20	13	14	0	0	1	4	9	7
South Carolina [4]	1	22	1	1	5	5	0	0	0	3	9	9
Georgia [4]	0	1	1	10	6	6	0	12	0	11	17	7
Florida [4]	0	1	1	5	9	4	1	0	0	3	2	2
E. SO. CEN.												
Kentucky	0	0	0	37	19	19	1	1	0	5	5	5
Tennessee	0	0	0	44	38	18	3	55	1	20	9	9
Alabama [4]	0	1	1	7	10	6	4	0	0	2	10	7
Mississippi [2]	1	0	0	5	1	2	0	0	0	1	3	3
W. SO. CEN.												
Arkansas	0	0	0	11	4	4	4	5	2	4	11	10
Louisiana [4]	1	0	1	7	2	6	1	0	0	7	10	10
Oklahoma [4]	0	0	0	10	10	19	1	40	8	5	7	7
Texas [4]	2	2	0	19	30	50	3	7	13	8	12	12
MOUNTAIN [3]												
Montana	0	0	0	5	14	12	0	2	5	1	0	1
Idaho [3]	3	0	0	4	2	6	0	0	1	1	0	0
Wyoming [3]	0	0	0	3	4	8	1	0	3	0	0	0
Colorado [3] [5]	0	0	0	22	33	37	1	6	3	2	1	1
New Mexico	0	0	0	2	4	9	0	1	0	0	0	1
Arizona	0	7	0	0	4	13	0	3	0	0	1	2
Utah [2] [3]	0	0	0	9	23	23	0	1	0	0	3	0
PACIFIC												
Washington	25	0	0	40	29	29	0	3	3	2	28	1
Oregon [3]	1	1	0	6	11	23	0	7	7	0	0	3
California	9	17	5	92	137	175	1	2	8	5	7	7
Total	47	60	36	3,476	2,559	4,379	47	337	242	147	210	197
22 weeks	544	511	468	104,165	103,808	145,153	1,545	7,618	6,750	1,958	2,720	2,720

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 1, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended— June 1, 1940	Whooping cough, Week ended— June 3, 1939	Division and State	Whooping cough, Week ended— June 1, 1940	Whooping cough, Week ended— June 3, 1939
NEW ENG.			SO. ATL.—continued		
Maine	12	27	South Carolina [4]	24	69
New Hampshire	16	0	Georgia [4]	17	48
Vermont	7	39	Florida [4]	2	47
Massachusetts	130	109	E. SO. CEN.		
Rhode Island	0	43	Kentucky	72	15
Connecticut	33	45	Tennessee	33	70
MID. ATL.			Alabama [4]	11	108
New York	343	334	Mississippi [2]		
New Jersey	58	294	W. SO. CEN.		
Pennsylvania	238	194	Arkansas	15	20
E. NO. CEN.			Louisiana [4]	48	6
Ohio	289	169	Oklahoma [4]	10	3
Indiana	16	71	Texas [4]	391	120
Illinois	50	233	MOUNTAIN		
Michigan [2]	217	163	Montana [3]	4	6
Wisconsin	60	140	Idaho [3]	12	7
W. NO. CEN.			Wyoming [3]	1	0
Minnesota	41	43	Colorado [3 5]	20	28
Iowa	26	25	New Mexico	14	18
Missouri	28	22	Arizona	42	5
North Dakota	5	1	Utah [2 3]	147	47
South Dakota	3	1	PACIFIC		
Nebraska	12	7	Washington	41	16
Kansas	30	28	Oregon [3]	36	17
SO. ATL.			California	385	181
Delaware	0	20	Total	3,202	3,268
Maryland [2 3]	81	35	22 weeks	69,784	87,076
Dist. of Col.	8	27			
Virginia [3]	68	128			
West Virginia [2]	83	33			
North Carolina	107	197			

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Rocky Mountain spotted fever, week ended June 1, 1940, 18 cases as follows: Maryland, 2; Virginia, 1; Montana, 3; Idaho, 2; Wyoming, 4; Colorado, 2; Utah, 3; Oregon, 1.
[4] Typhus fever, week ended June 1, 1940, 16 cases as follows: South Carolina, 1, Georgia, 5; Florida, 4, Alabama, 2; Louisiana, 1; Oklahoma, 1; Texas, 1.
[5] Colorado tick fever, week ended June 1, 1940, Colorado, 9 cases.

VENEREAL DISEASES

New Cases Reported for March 1940 [1]

Reports from States

	Syphilis									Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All Syphilis [2]					
	Primary and secondary	Early-latent [3]	Rate per 10,000 population	Includes late-latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population
Alabama	242	180	1.44	201	0.69	49	0.17	1,366	4.67	319	1.09	4	0.01
Alaska [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Arizona	27	22	1.17	45	1.08	26	.62	230	5.50	142	3.40	1	.02
Arkansas	215	210	2.05	598	2.88	24	.12	1,160	5.59	147	.71	6	.03
California [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Colorado	82	-----	.76	151	1.40	17	.16	250	2.32	109	1.01	-----	-----
Connecticut	16	5	.12	80	.51	12	.07	162	.93	101	.58	-----	-----
Delaware	11	19	1.14	23	.87	5	.19	140	5.32	23	.87	-----	-----
District of Columbia	-----	-----	-----	-----	-----	-----	-----	631	9.92	272	4.28	6	.09
Florida	8	470	2.81	1,104	6.50	61	.36	1,787	10.52	136	.80	8	.05
Georgia	-----	1,232	3.96	804	2.78	-----	-----	2,006	6.73	74	.24	7	.02
Hawaii	4	3	.17	27	.67	6	.15	56	1.38	51	1.26	-----	-----
Idaho	11	-----	.22	[5] 25	.50	2	.04	41	.82	15	.30	-----	-----
Illinois	119	422	.68	1,340	1.69	86	.11	1,967	2.48	1,247	1.58	42	.05
Indiana	95	31	.36	278	.80	18	.05	570	1.63	138	.40	3	.01
Iowa	57	51	.43	122	.48	21	.08	267	1.04	126	.49	-----	-----
Kansas	45	32	.41	78	.42	18	.10	211	1.13	73	.39	-----	-----
Kentucky	98	16	.39	278	.94	17	.06	590	1.99	312	1.05	3	.01
Louisiana	206	-----	.96	-----	-----	-----	-----	511	2.38	101	.47	3	.01
Maine	18	-----	.21	13	.15	5	.06	36	.42	29	.34	-----	-----
Maryland	92	23	.68	249	1.48	11	.07	950	5.64	305	1.81	17	.10
Massachusetts	64	-----	.14	[5] 419	.95	18	.04	501	1.13	308	.70	-----	-----
Michigan	83	98	.37	433	.89	44	.09	813	1.67	573	1.17	18	.04
Minnesota	22	20	.16	168	.63	5	.02	215	.80	171	.64	-----	-----
Mississippi	503	987	7.30	806	3.95	83	.41	5,276	25.86	2,271	11.13	-----	-----
Missouri	162	375	1.34	250	.62	41	.10	856	2.13	203	.50	5	.01
Montana	12	-----	.22	23	.42	2	.04	42	.77	20	.37	-----	-----
Nebraska	27	16	.32	25	.18	1	.01	69	.51	50	.37	-----	-----
Nevada	-----	4	.89	8	.78	3	.29	15	1.47	16	1.57	-----	-----
New Hampshire	1	2	.06	5	.10	2	.04	19	.37	5	.10	-----	-----
New Jersey	121	129	.80	581	1.33	43	.10	1,013	2.32	230	.53	1	.002
New Mexico	28	-----	.66	78	1.85	9	.21	115	2.73	59	1.40	-----	-----
New York	353	326	.52	2,773	2.13	176	.14	3,874	2.98	1,547	1.19	18	.01
North Carolina	283	964	3.53	862	2.44	65	.18	2,174	6.16	302	.86	21	.06
North Dakota [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ohio [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Oklahoma	-----	-----	-----	-----	-----	-----	-----	833	3.24	254	.99	-----	-----
Oregon	21	14	.34	47	.45	5	.05	92	.89	83	.80	-----	-----
Pennsylvania	345	909	1.29	255	.25	82	.08	1,651	1.61	-----	-----	-----	-----
Rhode Island	7	3	.15	53	.78	6	.09	79	1.16	27	.40	-----	-----
South Carolina	636	615	6.61	820	4.33	66	.35	2,219	11.73	69	.36	5	.03
South Dakota	11	5	.23	29	.42	2	.03	51	.74	25	.36	-----	-----
Tennessee	309	482	2.71	727	2.49	55	.19	1,577	5.39	361	1.23	9	.03
Texas	687	412	1.76	989	1.59	146	.23	2,740	4.40	846	1.36	87	.14
Utah	15	6	.40	50	.96	11	.21	82	1.57	45	.86	-----	-----
Vermont	8	-----	.21	12	.31	1	.03	22	.57	9	.23	-----	-----
Virginia	377	331	2.58	772	2.81	68	.25	1,691	6.16	262	.96	-----	-----
Washington	47	34	.48	88	.53	7	.04	192	1.15	231	1.38	-----	-----
West Virginia	257	98	1.87	179	.94	30	.16	956	5.02	256	1.35	-----	-----
Wisconsin	7	-----	.02	80	.27	4	.01	91	.31	75	.25	-----	-----
Wyoming	7	1	.34	8	.34	1	.04	25	1.05	18	.76	1	.04
Puerto Rico [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Virgin Islands [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	5,739	8,610	1.27	16,025	1.41	1,354	.12	40,304	3.54	12,036	1.06	265	.04

See footnotes at end of table.

Reports from cities of 200,000 population or over

	Syphilis									Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All Syphilis					
	Primary and secondary	Early-latent	Rate per 10,000 population	Includes late-latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population
Akron	8	16	.87	29	1.05	6	.22	59	2.15	20	.73	-----	-----
Atlanta	-----	77	2.56	206	6.86	-----	-----	283	9.43	36	1.20	-----	-----
Baltimore	78	10	1.05	190	2.27	2	.02	610	7.30	195	2.33	15	.18
Birmingham	94	55	5.06	131	4.45	12	.41	385	13.08	36	1.22	1	.03
Boston	29	-----	.36	94	1.18	7	.09	102	2.04	131	1.65	-----	-----
Buffalo	10	1	.18	58	.96	-----	-----	69	1.15	39	.65	-----	-----
Chicago	83	228	.85	849	2.32	38	.10	1,198	3.27	851	2.32	40	.11
Cincinnati	-----	-----	-----	-----	-----	-----	-----	216	4.57	125	2.65	-----	-----
Cleveland	24	29	.56	124	1.31	13	.14	190	2.01	74	.78	-----	-----
Columbus	16	39	1.75	41	1.31	6	.19	102	3.25	27	.86	1	.03
Dallas	38	34	2.37	105	3.45	2	.07	179	5.89	134	4.41	19	.63
Dayton	18	9	1.22	32	1.44	1	.05	60	2.71	45	2.03	-----	-----
Denver	-----	-----	-----	-----	-----	-----	-----	142	4.71	68	2.26	-----	-----
Detroit	51	75	.69	418	2.30	13	.07	557	3.07	345	1.90	23	.13
Houston	85	31	1.84	167	4.66	24	.67	377	10.52	124	3.46	2	.06
Indianapolis	9	1	.26	18	.47	1	.03	114	2.96	35	.91	-----	-----
Jersey City	5	6	.34	25	.77	1	.03	37	1.14	9	.28	-----	-----
Kansas City [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Los Angeles	-----	128	.84	516	3.39	20	.13	664	4.36	442	2.91	4	.03
Louisville	21	4	.74	112	3.30	10	.30	147	4.34	305	9.00	3	.09
Memphis [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Milwaukee	2	-----	.03	57	.90	1	.02	60	.95	18	.29	18	.29
Minneapolis	7	26	.66	23	.46	-----	-----	65	1.30	45	.90	1	.02
Newark	54	-----	1.19	233	5.13	16	.35	393	8.65	90	1.98	-----	-----
New Orleans [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
New York	281	320	.81	1,869	2.49	99	.13	2,809	3.75	1,202	1.60	11	.01
Oakland	6	9	.48	46	1.47	-----	-----	61	1.95	56	1.79	-----	-----
Omaha	13	4	.76	20	.89	1	.04	38	1.70	27	1.21	-----	-----
Philadelphia	229	631	4.29	-----	-----	32	.16	892	4.45	73	.36	-----	-----
Pittsburgh	-----	-----	-----	-----	-----	-----	-----	341	4.84	12	.17	-----	-----
Portland [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Providence	4	3	.27	32	1.23	1	.04	50	1.93	17	.65	-----	-----
Rochester	-----	-----	-----	16	.47	1	.03	17	.50	38	1.11	-----	-----
St. Louis	42	234	3.27	416	4.93	44	.52	736	8.73	195	2.31	11	.13
St. Paul	-----	-----	-----	-----	-----	-----	-----	30	1.04	20	.70	-----	-----
San Antonio [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
San Francisco	52	-----	.75	242	3.51	8	.12	302	4.38	198	2.87	14	.20
Seattle	5	18	.59	68	1.76	4	.10	99	2.56	105	2.71	1	.03
Syracuse [4]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Toledo	4	6	.32	57	1.83	6	.19	72	2.31	11	.35	2	.06
Washington, D. C.	-----	-----	-----	-----	-----	-----	-----	631	9.92	272	4.28	6	.09
Total	1,218	2,000	1.16	6,194	2.23	369	.13	12,147	4.03	5,420	1.80	172	.08

[1] Figures preliminary and subject to correction.
[2] Includes "not stated" diagnosis.
[3] Duration of infection under 4 years.
[4] No report for current month.
[5] Includes early latent, late, and late latent.

WEEKLY REPORTS FROM CITIES

City reports for week ended May 18, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	134	84	37	5,998	558	1,973	20	303	26	1,234	--------
Current week[1]	68	57	16	3,554	409	2,067	1	344	20	1,051	--------
Maine:											
Portland	0	------	0	100	0	0	0	0	0	1	17
New Hampshire:											
Concord	0	------	0	0	2	0	0	0	0	0	8
Manchester	0	------	0	0	1	0	0	0	0	0	11
Nashua	0	------	0	1	0	2	0	0	0	0	4
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	6	10
Rutland	0	------	0	0	0	0	0	0	0	0	6
Massachusetts:											
Boston	1	------	2	159	15	50	0	8	0	76	239
Fall River	3	------	0	55	1	1	0	0	0	4	30
Springfield	0	------	0	2	1	11	0	3	0	12	45
Worcester	0	------	0	107	1	0	0	0	0	6	46
Rhode Island:											
Pawtucket	0	------	0	1	0	0	0	0	0	0	15
Providence	1	------	1	118	4	6	0	1	1	9	61
Connecticut:											
Bridgeport	0	------	0	2	2	4	0	1	0	0	26
Hartford	0	------	0	1	4	18	0	2	0	0	42
New Haven	2	------	0	1	3	6	0	0	0	1	53
New York:											
Buffalo	2	------	0	5	9	17	0	4	0	2	148
New York	15	14	0	204	91	727	0	69	8	105	1,448
Rochester	0	------	0	7	4	17	0	0	1	7	76
Syracuse	0	------	0	0	1	9	0	0	0	0	43
New Jersey:											
Camden	2	------	0	1	3	13	0	0	0	0	32
Newark	0	2	0	460	8	35	0	0	0	15	105
Trenton	0	------	0	1	2	2	0	3	0	6	45
Pennsylvania:											
Philadelphia	2	------	0	145	19	123	0	27	0	32	479
Pittsburgh	1	2	1	3	15	24	0	4	2	15	168
Reading	0	------	0	1	0	1	0	4	0	8	29
Scranton	0	------	--------	0	-------	2	0	-------	0	0	--------
Ohio:											
Cincinnati	1	1	0	4	5	17	0	4	0	17	96
Cleveland	0	11	2	6	12	44	0	16	0	34	203
Columbus	1	1	1	1	3	10	0	3	0	19	80
Toledo	0	------	0	4	3	43	0	1	1	11	61
Indiana:											
Anderson	0	------	0	0	1	0	0	0	0	3	6
Fort Wayne	0	------	0	3	1	0	0	0	0	0	28
Indianapolis	2	------	0	5	9	15	0	6	1	13	94
Muncie	0	------	0	0	2	0	1	0	0	0	21
South Bend	0	------	0	1	2	1	0	0	0	2	23
Terre Haute	0	------	0	0	0	2	1	1	0	1	19
Illinois:											
Alton	0	------	0	0	0	1	0	0	0	9	11
Chicago	2	2	2	99	28	483	0	36	0	37	711
Elgin	0	------	0	0	0	0	0	0	0	1	7
Moline	0	------	0	3	0	0	0	0	0	0	14
Springfield	0	------	0	0	2	4	0	0	0	0	26
Michigan:											
Detroit	5	1	0	216	11	108	0	12	2	92	297
Flint	0	------	0	8	7	20	0	0	0	10	20
Grand Rapids	0	------	0	6	1	29	0	0	0	18	40
Wisconsin:											
Kenosha	0	------	0	86	0	3	0	0	0	0	9
Madison	0	------	0	32	0	5	0	0	0	9	24
Milwaukee	0	1	1	120	4	84	0	2	0	1	106
Racine	0	------	0	1	0	7	0	1	0	2	9
Superior	0	------	0	105	2	4	0	0	0	0	8

[1] Figures for Barre estimated; report not received.

City reports for week ended May 18, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0		0	11	2	1	0	1	0	0	24
Minneapolis	1		1	1	3	23	0	1	0	10	86
St. Paul	0		0	4	2	2	0	3	0	12	58
Iowa:											
Cedar Rapids	0			63		0	0		0	1	
Davenport	0			5		5	1		1	0	
Des Moines	0			11		9	1		0	0	31
Sioux City	1			2		3	0		0	0	
Waterloo	0			5		4	0		0	1	
Missouri:											
Kansas City	0		0	5	8	7	0	5	0	0	89
St. Joseph	0		0	0	0	0	0	1	0	0	28
St. Louis	1	2	0	8	3	20	0	5	1	12	215
North Dakota:											
Fargo	0		0	0	0	0	0	0	0	0	10
Grand Forks	0			0		0	0		0	0	
Minot	1		0	0	0	0	1	0	0	0	6
South Dakota:											
Aberdeen	0			0		0	0		0	0	
Sioux Falls	1		0	0	0	2	0	0	0	0	8
Nebraska:											
Lincoln	0			1		8	0		0	2	
Omaha	4		0	5	3	0	0	3	0	8	51
Kansas:											
Lawrence	0		0	0	0	0	0	0	0	0	3
Topeka	0		0	21	4	2	0	1	0	1	25
Wichita	0	1	0	3	4	0	0	0	0	5	23
Delaware:											
Wilmington	0		0	0	1	1	0	0	0	0	30
Maryland:											
Baltimore	0	2	1	3	13	14	0	10	0	119	214
Cumberland	0		0	0	0	0	0	0	0	0	18
Frederick	0		0	0	0	0	0	1	0	0	6
Dist. of Col.:											
Washington	2		0	3	10	33	0	8	0	5	173
Virginia:											
Lynchburg	0		0	2	0	0	0	0	0	5	9
Norfolk	0	8	0	16	2	2	0	0	1	0	16
Richmond	0		0	4	4	6	0	2	0	3	47
Roanoke	0		0	18	0	1	0	0	0	0	14
West Virginia:											
Charleston	0	1	0	0	1	0	0	0	1	0	28
Huntington	2			0		4	0		0	0	
Wheeling	0			1		0	0		0	4	
North Carolina:											
Gastonia	0			0		0	0		0	0	
Raleigh	0		0	0	0	0	0	1	0	5	6
Wilmington	0		0	1	0	1	0	1	0	0	12
Winston-Salem	0		0	0	0	1	0	1	0	2	10
South Carolina:											
Charleston	0	8	0	0	3	0	0	2	0	0	24
Florence	0		0	0	0	0	0	0	0	0	4
Greenville	0		0	0	6	0	0	0	0	0	21
Georgia:											
Atlanta	0		0	6	6	3	0	9	0	0	92
Brunswick	0		0	1	0	1	0	1	0	0	3
Savannah	0	1	0	2	1	1	0	3	2	0	30
Florida:											
Miami	0	1	1	1	1	1	0	2	0	0	35
Tampa	0	1	0	48	1	1	0	4	0	1	15
Kentucky:											
Ashland	0		0	16	1	0	0	0	0	12	8
Covington	0		0	8	0	1	0	1	0	0	14
Lexington	0		0	24	1	1	0	1	0	3	16
Louisville	0		0	6	3	25	0	4	0	73	86
Tennessee:											
Knoxville	1	1	0	11	2	8	0	1	1	1	31
Memphis	0	1	0	15	3	12	0	3	2	19	74
Nashville	0		0	10	2	2	0	8	0	15	40
Alabama:											
Birmingham	2	2	0	13	7	3	0	5	3	1	61
Mobile	0		0	0	0	0	0	2	0	0	21
Montgomery	0			2		0	0		0	4	

City reports for week ended May 18, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	----	----	0	----	0	0	----	0	0	----
Little Rock	0	1	0	0	2	0	0	1	0	1	----
Louisiana:											
Lake Charles	0	----	0	2	1	0	0	0	0	0	6
New Orleans	7	1	1	3	13	5	0	8	2	22	147
Shreveport	1	----	0	0	4	0	0	0	0	3	32
Oklahoma:											
Oklahoma City	0	3	0	0	3	3	0	1	0	0	45
Texas:											
Dallas	2	----	0	650	2	1	0	4	0	20	56
Fort Worth	0	----	0	12	0	0	0	2	0	36	44
Galveston	0	----	0	0	0	1	0	1	0	0	18
Houston	3	----	1	10	9	0	0	4	0	4	69
San Antonio	0	----	0	5	5	0	0	10	0	0	77
Montana:											
Billings	0	----	0	0	1	0	0	0	0	0	7
Great Falls	0	----	0	21	1	2	0	0	0	0	11
Helena	0	----	----	0	----	0	0	----	0	0	----
Missoula	0	----	0	0	0	0	0	0	0	0	11
Idaho:											
Boise	0	----	0	2	0	2	0	0	0	0	5
Colorado:											
Colorado Springs	0	----	0	3	0	0	0	0	0	0	8
Denver	4	----	2	34	2	8	0	4	0	1	70
Pueblo	0	----	0	6	1	5	0	2	0	0	12
New Mexico:											
Albuquerque	0	1	0	0	1	0	0	3	0	2	13
Utah:											
Salt Lake City	0	----	0	260	2	5	0	0	0	116	30
Washington:											
Seattle	0	----	0	207	3	5	0	1	0	17	92
Spokane	0	----	0	8	0	4	0	0	0	1	29
Tacoma	0	----	0	1	1	4	0	0	0	0	32
Oregon:											
Portland	0	----	0	83	0	6	0	0	0	6	51
Salem	0	----	----	2	----	0	0	----	0	0	----
California:											
Los Angeles	1	6	0	22	7	23	0	22	0	56	353
Sacramento	0	----	0	11	1	5	0	1	0	17	20
San Francisco	0	----	0	5	7	8	0	0	3	21	171

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
New York:			
Buffalo	3	3	0
New York	1	0	1
Pennsylvania:			
Pittsburgh	1	0	0
Ohio:			
Cleveland	0	0	1
Maryland:			
Baltimore	1	0	0
West Virginia:			
Huntington	0	1	0
Louisiana:			
Shreveport	0	1	0
Utah:			
Salt Lake City	0	0	1
Washington:			
Tacoma	0	0	2
California:			
Los Angeles	0	0	2

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Alton, 1; Helena, 1.
Pellagra.—Cases: Boston, 1; Atlanta, 1; Los Angeles, 1.
Typhus fever.—Cases: New York, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended May 4, 1940.—During the week ended May 4, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1	1	5	1			1		9
Chickenpox		1	2	101	233	33	5	15	59	449
Diphtheria				23		6	1			30
Influenza		10			94				6	110
Lethargic encephalitis				2			1			3
Measles		7		186	343	514	375	3	73	1,501
Mumps				26	278	10	21		14	349
Pneumonia	5	8			30		4		8	50
Scarlet fever			3	102	155	16	4	23	5	308
Tuberculosis	6	2	26	53	59	4	4	1		155
Typhoid and paratyphoid fever		1		30	12					43
Whooping cough		29	2	147	128	39	68		21	434

CUBA

Provinces—Notifiable diseases—4 weeks ended April 27, 1940.—During the 4 weeks ended April 27, 1940, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	1	2		6	2	5	16
Chickenpox		2		2	9	2	15
Diphtheria		10	1	3		3	17
Hookworm disease				1			1
Leprosy			1	1		1	3
Lethargic encephalitis		1					1
Malaria	12			3		23	38
Measles	2	8	6	2	2	9	29
Meningitis, tubercular		1					1
Poliomyelitis				1		1	2
Tuberculosis	27	30	16	26	12	21	141
Typhoid fever	17	120	5	39	15	40	245

SWITZERLAND

Notifiable diseases—March 1940.—During the month of March 1940, cases of certain notifiable diseases were reported in Switzerland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	138	Mumps	72
Chickenpox	109	Paratyphoid fever	3
Diphtheria	45	Poliomyelitis	5
German measles	125	Scarlet fever	398
Influenza	2,498	Tuberculosis	224
Lethargic encephalitis	4	Undulant fever	11
Measles	1,600	Whooping cough	197

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of May 31, 1940, pages 1000-1002. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Smallpox

China.—During the week ended May 4, 1940, 1 case of smallpox was reported in Shanghai, 1 case in Hong Kong, and 23 cases in Macao, China.

Thailand—Bangkok.—During the week ended May 4, 1940, 4 cases of smallpox, with 1 death, were reported in Bangkok, Thailand.

Typhus Fever

Japan—Tokyo.—On April 26, 1940, a case of typhus fever was reported in Tokyo, Japan.

Public Health Reports

VOLUME 55 JUNE 14, 1940 NUMBER 24

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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CONTENTS

Public Health Reports

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TRAPPING RATS ON SHIPS

The secret of keeping a vessel free of rats lies in the continuous, energetic application of the principles of good housekeeping to ships. A number of steamship companies find it easy and comparatively inexpensive to apply these principles and thus keep their vessels in faultless sanitary condition. For these, freedom from rats and the consequent avoidance of fumigation is merely one of the advantages to be derived from keeping ships clean.

On the other hand, there are some vessels, especially those in coast-wise service, the operators of which have failed to grasp the significance of rat infestation and are not aware of the many benefits which result from rat control. This article has been prepared for the purpose of stimulating the interest of these operators, their agents, and the personnel of their vessels, and to provide practical suggestions for keeping ships free of rats.

Why a Ship Should Be Kept Free of Rats.

1. Because the rat is a reservoir of a number of dangerous diseases, among them plague and typhus fever. Infected rats may bring these diseases to us from foreign ports or may spread the infections from one to another of our own ports.
2. Because rats eat and soil large quantities of food, deface and destroy portions of a ship's structure, and damage cargo and the containers in which it is packed.

Methods of Controlling Rats on Ships.

1. Ratproof construction of new ships.
2. Eliminating harborages and nesting places on all ships.
3. Starving rats by making food scarce. This measure includes the removal of spilled grain and foodstuffs from holds, the protection of ship's stores, and the prompt disposal of garbage and waste food. Whatever is done to perfect these measures will supplement all other measures of rat control.
4. Trapping, by means of snap traps of the dead-fall or guillotine type.
5. Poisoning.
6. Fumigation with a deadly gas such as hydrocyanic acid gas.

Choice of Control Methods.

Rats may be killed with certainty in any enclosed structure by using a deadly fumigant such as hydrocyanic acid gas, provided all harboring places have been opened up to permit free access of the gas to rats wherever they may seek harborage. When a vessel is heavily infested with rats, fumigation is the measure of choice to secure immediate results; but unless it is repeated at relatively short intervals, fumigation cannot be depended on to prevent the building up of a ship's rat population. Because of the danger to human life and the expense incident to the use of hydrocyanic acid gas, other measures for rat control should be given a thorough trial before resort is made to the gas routinely.

Many structural defects which make rat harboring easy and safe may be overcome at the time a vessel is built by applying the principles of ratproof design and construction. The same principles may with advantage be applied to vessels already in operation, but under no circumstances should entire dependence be placed on ratproofing. If rat life is to be controlled, even the theoretically ratproof ship must at all times be kept in a clean and orderly condition.

The systematic removal of debris remaining after the discharge of cargo confers a twofold benefit: (1) The removal of waste that might provide food for rats, and (2) the elimination of potential harborages. Accumulations of seldom-used dunnage, surplus gear, and other equipment furnish ideal harborages. All such material as is not needed should be removed from the vessel, and that which remains on board should frequently be disturbed and rearranged or, preferably, should be stowed on racks elevated above decks.

Methods of extermination, such as starving, trapping, and poisoning, are essentially related in that they supplement each other. Trapping and poisoning, of course, are more effective when sources of food supply, other than bait, are cut off. Separating the rat from its customary food supply is closely linked to the system of ship sanitation, previously referred to as good housekeeping. Poisoning is of doubtful value on two counts: First, there is the danger of accidental harm to human beings and lower animals; and, second, it is often impossible to secure visible evidence of the results obtained with this measure.

Trapping is recommended as being the most effective method of exterminating rats on ships, especially clean ships on which measures are energetically applied to prevent ready access of rats to food supplies. Trapping is also to be recommended on the grounds that it is inexpensive, comparatively easy of application by the ship's regular personnel, and causes no loss of time during the routine operation of the vessel, either at dock or at sea.

Requirements for Success in Trapping.

The trapping of rats is most successfully undertaken by men with well-developed hunting instincts. After all, the rat is a wild animal, able to live near man because of superior cunning. The survival of the rat in this close but antagonistic association is proof of its resourcefulness, adaptability, persistence, agility, and hardihood.

To cope with the rat, one must know its habits and learn to outwit the animal. Careful study and persistent effort are required, because the rat will make the most of every opportunity. If turned back at one point, it will appear at another.

Rats Found on Ships.

The two varieties of rats most frequently encountered on shipboard are the Alexandrine (gray) and Indian (black). The Norway (brown) is found to a lesser extent, but is not averse to shipboard conditions.

Characteristics of Rats Which Make Control Difficult.

Rats are able to—

1. Climb with ease and rapidity surfaces affording slight footholds, such as rough seams, wall angles, and perpendicular pipes.
2. Jump a distance several times their own length.
3. Run along pipes, wires, and narrow beams, even though partially blocked by structural elements running at right angles.
4. Squeeze through small openings.
5. Survive in small spaces with restricted air supply.
6. Subsist on small quantities of food.
7. Secure sufficient water from food or from condensation on metallic surfaces.

Factors Governing Rat Control on Shipboard.

Knowledge of the habits of rats is essential to satisfactory control. The following points may be emphasized in this connection:

1. The female rat requires a sheltered place in which to nest and rear the young. Therefore, such locations should be sought by inspectors and trappers.
2. In order to nourish large and frequent litters, the female must have sufficient food.
3. Rats seek safe and inconspicuous harborages, even for temporary sojourns.
4. Repeatedly used runways disclose evidence of a rat's presence and the routes to hiding places.
5. Rat signs include droppings (excreta), marks of gnawing, and trails made by feet, tails, and bodies.

Inspection Hints.

With some attention to the foregoing details, inspectors and trappers can locate freshly marked runways leading to probable hiding

and nesting places. Taking into consideration the various signs, an inspector should be able to estimate, with comparative accuracy, the approximate number and whereabouts of rats on a ship.

Traps: Their Care and Use.

Although numerous devices are available, it has been found that the most effective trap for ship use is the so-called snap trap. Of convenient size for placing in small spaces and on narrow runways, this trap is nevertheless sufficiently powerful to kill a full-grown rat.

In this type of trap the dead-fall, operated by a coiled spring stapled to a small, flat board, is released when the rat attempts to seize the bait which is affixed to the trigger. Such a trap, baited and set, is illustrated in figure 1.

In order to be effective, traps must be kept clean. Frequent wiping with an oiled cloth aids in keeping the metal parts of the trap rust-free, which is essential to fast spring and dead-fall action. Because rats are suspicious of the human odor, traps should preferably be handled by hands encased in frequently-washed cotton gloves. Occasionally the traps may be brushed lightly with oil of anise to cover the odor of human contact and to increase their attractiveness to rats.

Much of the success of trapping depends upon the kind of bait used and upon the ingenuity with which the experienced trapper applies his knowledge of the habits and food preferences of rats. For example, in initiating trapping, the rat's natural suspicion may be overcome by placing attractively baited but unset traps around for a day or two, during which time the animal is misled into believing that the trap is a safe source of food. A hungry rat will be attracted by many kinds of food, such as stale bread, raw meat, bacon, fresh and smoked fish, cheese, fruit, and vegetables; but when food is plentiful outside of traps, rats are extremely "choosey," and the trapper must experiment with a variety of baits to determine what food is in demand. When sources of water supply are scarce or inaccessible on a vessel, a moist bait is likely to be most attractive.

Freshly baited traps should be set in runways and other places late in the day after work on a ship has stopped, the locations of the settings being carefully recorded. On the following morning the traps should be examined, dead rats removed, and the traps cleaned and repaired pending resetting with fresh bait. After a ship's hold has been loaded, and before the hatches are replaced, traps should be set on top of the cargo in anticipation of a further catch. A trapper should constantly seek new and more advantageous locations for his traps. By keeping a written record of locations in which rats are caught, later trapping efforts will be simplified and systematized. The trapper who studies the habits of rats, pursuing his quarry diligently and persistently, will be able to maintain satisfactory control, especially if the vessel is kept

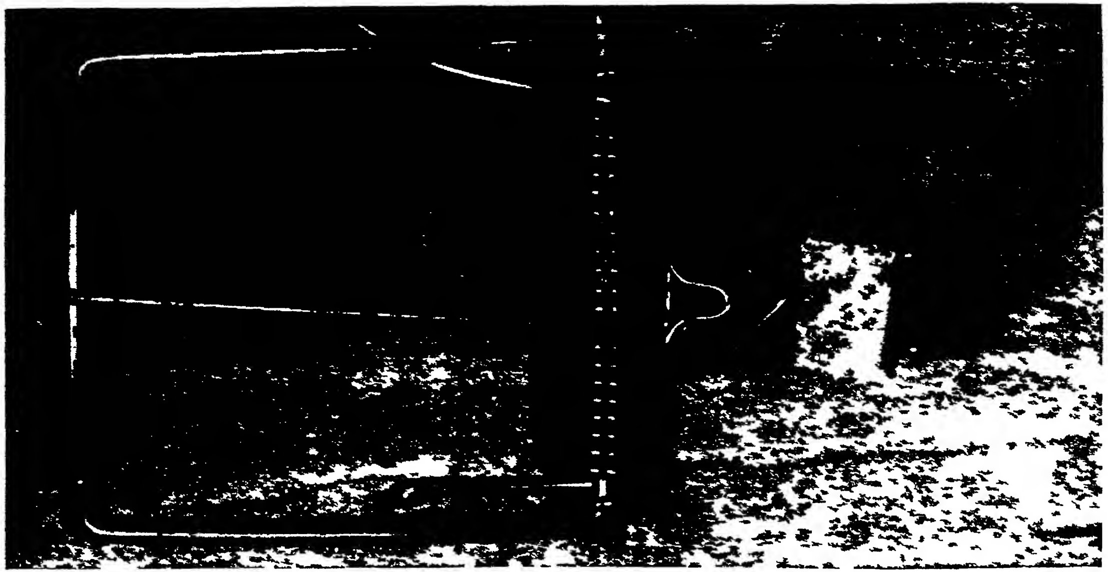

FIGURE 1 —Approved type of trap, baited and set The trap is 7 inches in length

clean. However, rats may invade clean ships or be brought aboard in cargo even when reasonable precautions are observed. Fortunately, an alert trapper can destroy such rodents before harborages are established and the species propagated.

Disposal of Dead Rats.

Dead rats should be removed from traps with gloved hands. They should then be placed in paper or finely meshed cloth bags and burned.

References.

It is not practicable in the present article to cover completely the subject of rat control on vessels. However, those interested in the details of ship ratproofing, infestation inspections, and sanitary maintenance of vessels, will find much of practical value in the following publications of the United States Public Health Service. Copies of these publications may be obtained, at the prices quoted, from the Superintendent of Documents, Government Printing Office, Washington, D. C.

The Ratproofing of New Ships. Supplement No. 151 to the Public Health Reports. (15 cents).
Rat Infestation Inspection of Vessels. (Reprint No. 1529 from the Public Health Reports.) (10 cents).
Some Experiments with Rats and Rat Guards. (Reprint No. 1827 from the Public Health Reports.) (10 cents).
Sanitary Units on Ships; Organization and Operation. Public Health Reports, vol. 55, No. 11, March 15, 1940 (5 cents).

IMMUNITY TO THE LANSING STRAIN OF POLIOMYELITIS AS REVEALED BY THE PROTECTION TEST IN WHITE MICE [1]

By V. H. Haas, *Passed Assistant Surgeon*, and Charles Armstrong, *Senior Surgeon, United States Public Health Service*

In a previous communication (*1*) it was pointed out that the Lansing strain of poliomyelitis could be employed with the cotton rat to determine the protective properties of sera. It was also shown that white mice could be similarly employed (*2*) and that the results were in marked agreement in the two species when the same sera were employed, and that the results were repeatable.

In table 1 are presented the results of neutralization tests in both cotton rats and white mice employing the same virus suspension and the same sera. The virus utilized in these tests was the cotton rat strain of Lansing virus which had been carried through 23 successive passages in mice. The cotton rat strain of virus prior to passage in the white mouse, while utilizable, was inferior to the mouse adapted strain since the former often failed to produce paralysis and death with

[1] From the Division of Infectious Diseases, National Institute of Health.

all mice when known negative sera were employed and the incubation period in mice with the unadapted strain tended to be quite variable and often prolonged.

TABLE 1.—*Serum-virus neutralization test in cotton rats and white mice*

Source of serum	Cotton rats [1]					Mice [2]				
	Serum dilution	Number of rats	Day of death following inoculation	Survived	Immunity	Serum dilution	Number of mice	Day of death following inoculation	Survived	Immunity
Monkey 609, negative control.	1/40	1	6	0		1/10	4	5 [3], 6, 8, 10	0	
	1/40	1	5	0	−	1/20	4	6, 8, 13, 21	0	−
	1/40	1	5	0		1/40	4	2 [3], 6, 7, 12	0	
Human serum, D. D	1/40	1		1		1/10	4		4	
	1/40	1		1	+	1/20	4		4	+
	1/40	1		1		1/40	4		4	
Human serum, T. C	1/40	1	9	0		1/10	4	4 [3], 6, 6, 8	0	
	1/40	1	3 [4]	1	−	1/20	4	3 [3], 3 [3], 5, 6	0	−
	1/40	1	6	0		1/40	4	7, 7, 21	1	
Human serum, M. F	1/40	1	7	0		1/10	4	5, 7, 8, 10	0	
	1/40	1	12	0	−	1/20	4	5, 7 [3], 9, 14	0	−
	1/40	1	9	0		1/40	4	3, 5, 6, 6	0	
Human serum, J. V	1/40	1		1		1/10	4		4	
	1/40	1		1	+	1/20	4		4	+
	1/40	1		1		1/40	4	10 [3]	3	
Pooled serum from monkeys recovered from poliomyelitis.	1/40	1		1		1/10	4		4	
	1/40	1		1	+	1/20	4		4	+
	1/40	1		1		1/40	4		4	

[1] Tests made Mar. 8, 1940
[2] Tests made Mar 7, 1940.
[3] Died; no previous paralysis noted.
[4] Paralysis with recovery.

The tests reported in table 1 were performed on mice and cotton rats on successive days by the same worker (C. A.). The same sera and virus suspension were employed in each test, virus for the second test being held overnight at 3° to 5° C.

In view of the high degree of agreement found on several comparative trials with the two species and because of economy, availability, and ease of handling, white mice were selected as the animals of choice for the following serum-virus neutralization studies.

Tests on human sera.—A total of 83 human sera have been investigated, the actual tests in most instances being performed by V. H. H.

METHOD OF TESTING SERA

The virus used was the Lansing strain established in white mice by Armstrong (*1*). The spinal cord and base of the brain of mice, taken on the first day of paralysis, were the sources of the virus. Mice showing paralysis within a week of inoculation were usually selected and the virus was used on the day it was collected, without glycerinization. The base of the brain and the cord from two or three mice

were thoroughly triturated in a mortar and suspended in sufficient saline to make dilutions of approximately 1:10, 1:20, and 1:40 by volume (not centrifuged).

Each serum in 0.15 cc. amounts was mixed with 0.10 cc. of each virus dilution and allowed to stand for 1 hour at room temperature, being shaken at intervals.[2] Each serum-virus mixture was next inoculated intracerebrally into 4 mice (0.03 cc.), a total of 12 mice thus being utilized for each serum tested.

Sera were tested in groups of 4 to 10, and with each group a known positive serum and a known negative serum were employed as controls.

The animals were observed for 21 days, paralyses and deaths being recorded daily. Most of the paralyses occurred within 1 week after inoculation, but some developed even during the last few days of observation.

METHOD OF INTERPRETING RESULTS

The results were read in relation to the findings in the controls for each test. Where the controls were satisfactory [3] the following classifications were observed:

1. If 9 or more of the 12 mice survived without symptoms the serum was regarded as giving definite protection against the virus.
2. If 5 to 8 mice survived without symptoms while not more than 2 or 3 survived in the negative controls, the serum was regarded as showing moderate to questionable protection.
3. If less than 5 mice survived without symptoms, the serum was regarded as giving no protection.

CONSISTENCY OF RESULTS

Twenty sera were tested two or more times. In only two instances was there any tendency for results to fall into different categories, and even these discrepancies were slight. The sera used as controls also gave consistent results on repetition, as may be seen from table 2.

TABLE 2.—*Consistency of results given by sera used as controls for protection test*

Sera used as controls	Number of tests	Number of tests showing—			
		Definite protection	Moderate protection	Questionable protection	No protection
1. Pooled monkey serum, positive	14	[1] 13			
2. Human serum (Charleston), positive	3	3			
3. Uninoculated monkey serum, negative	6				[1] 5
4. Uninoculated monkey serum, positive	7				7
5. Human serum (Charleston), negative	4				4
6. Human serum (Charleston), negative	8				8

[1] One test excluded on account of the number of mice dying of unknown causes.

[2] Overnight icebox fixation was investigated and the results were identical.

[3] In a satisfactory negative serum not more than 3 mice should survive without paralysis. In a satisfactory positive control 9 to 12 mice should survive without paralysis.

ORIGIN OF SERA TESTED

There were 83 human sera tested; 69 were obtained in Charleston, S. C., and 14 from Detroit, Mich. Outbreaks of poliomyelitis occurred in both localities in 1939, and all poliomyelitis cases from which sera were obtained had been affected during these outbreaks, with the single exception of a case occurring in 1933.

The blood from the Detroit cases was sent to us by Dr. J. G. Molner, to whom we acknowledge our gratitude.

The origin of the sera is shown in table 3.

TABLE 3.—*Origin of sera tested*

Source of sera	Detroit, Mich.	Charleston, S. C.
Poliomyelitis cases	14	19
Family contacts of poliomyelitis cases		26
Children in orphanages where no cases occurred		20
Suspected cases, not reported as poliomyelitis		4
Total	14	69

The sera used as controls were obtained from the following sources:

Positive controls:

1. Pooled sera of monkeys surviving inoculation with poliomyelitis virus (PCMS XII) sent to us by Dr. E. H. Lenette.

2. A human serum from Charleston, S. C., which was found to give positive results comparable with the pooled monkey sera.

Negative controls:

Nos. 3 and 4. Sera from 2 uninoculated monkeys.

Nos. 5 and 6. Sera from 2 Charleston cases, giving negative results comparable to those given by the sera of the uninoculated monkeys.

RESULTS OBTAINED WITH CHARLESTON SERA

As shown in table 4, the sera of 12 of the 19 Charleston, S. C., poliomyelitis cases protected mice against the Lansing strain of virus. There is no evidence to indicate that ability of sera to neutralize this strain of virus was influenced by either the extent of involvement during the acute stage or the presence of residual involvement at the time the blood was taken.

When sera of the different groups of donors are compared, as shown in table 5, it is apparent that sera from the poliomyelitis cases gave less protection than from the other groups of persons tested. This fact is somewhat clarified, however, by consideration of the age groups into which the donors fall; 47 percent of the poliomyelitis cases tested were under 10 years of age whereas only 13 percent of the other donors were in this age group.

TABLE 4.—*Poliomyelitis cases, Charleston, S. C., whose sera were tested for neutralizing antibodies against the Lansing strain of poliomyelitis virus*

Patient	Race	Sex	Age (years)	Onset date, 1939	Date bled, 1940	Extent of involvement during acute stage	Condition at time blood was taken	Reaction of sera in neutralization tests
J. H.	C	F	5	Apr. 10	Jan. 31	Both legs	Residuals present	No protection.
T. W.	W	M	5	May 15	Feb. 1	No paralysis	No residuals	Protection.
L. A.	C	M	6	Feb. 5	Feb. 2	Left arm and hand; left abdominal.	Residuals present	Do.
A. P.	C	M	6	June 5	Jan. 31	Both legs	do	No protection.
M. M.	C	F	6	July 14	Jan. 30	Right arm; abdominals.	No residuals	Do.
Z. G.	C	F	6	(1)	Jan. 31	(1)	Residuals present	Do.
T. C.	C	F	7	Feb. 7	Jan. 29	Both arms, both legs	do	Do.
N. N.	C	M	9	May 19	Jan. 31	Weakness left leg	No residuals	Protection.
J. M.	W	M	9	July 23	do	Both legs; abdominals	Residuals present	No protection.
E. B.	C	F	11	May 4	Jan. 30	Both legs; left abdominal.	do	Protection.
M. G.	W	F	12	May 2	do	Both legs; abdominals.	Slight residuals	Do.
P. E.	W	M	12	May 31	Feb. 1	No paralysis	No residuals	Do.
H. C.	W	M	17	May 8	Jan. 30	do	do	Questionable
V. L.	W	F	18	May 15	do	Right arm; both legs	do	Protection.
L. M.	W	F	21	July 8	Feb. 1	Both legs; left arm	Residuals present	Do.
B. S.	W	F	21	Aug. 7	Feb. 3	No paralysis	No residuals	Do.
D. D.	C	F	24	June 10	Jan. 30	Both legs; right arm	Residuals present	Do.
R. Z.	W	M	27	Aug. 9	Jan. 31	No paralysis	No residuals	Do.
J. N.	C	M	11	1933	Jan. 29	Both legs	Residuals present	Do.

[1] No data.

TABLE 5.—*Protection shown by sera of poliomyelitis cases and others, Charleston, S. C.*

Classification of donors	Number of sera tested	Degree of protection: Definite protection, Number	Definite protection, Percent	Moderate to questionable	No protection
Poliomyelitis cases	19	12	63	1	6
Family contacts of cases	26	21	81	2	3
Children in orphanages	20	18	90	1	1
Suspected cases	4	1	25		3
Total	69	52	75	4	13

The results of the neutralization tests according to age groups are shown in table 6.

TABLE 6.—*Protection shown by sera of different donors, according to age,*[1] *Charleston, S. C.*

Age group	Cases: Number tested	Cases: Number protected	Cases: Percent protected	Contacts: Number tested	Contacts: Number protected	Contacts: Percent protected	Orphanages: Number tested	Orphanages: Number protected	Orphanages: Percent protected	Total: Number tested	Total: Number protected	Total: Percent protected
Under 10	9	3	33	6	3	50	None			15	6	40
10 to 19	6	5	83	10	8	80	20	18	90	36	31	86
20 and over	4	4	100	10	10	100	None			14	14	100

[1] 4 suspected cases of which 1 gave positive protection are omitted from table.

In each category, the percentage of sera giving protection rises with the age of the donors, and while the figures in each separate group are too small to be significant, those for all categories combined are large enough to give definite indication of this rise in protective ability with increasing age. Whereas only 6 of the 15 sera from all donors under 10 gave protection, 31 of the 36 in the age group 10 to 19 gave protection. All of 14 sera from persons 20 or more years old protected.

When adequate allowance is thus made for age of the donors, it appears that in this series of tests the factor which influenced the presence or absence of protective antibodies in the sera was the age of the donors, rather than their experience with clinical poliomyelitis.

This relative unimportance of experience with the recognized disease is shown when the different categories of sera falling in a single age group are compared. In table 7 this comparison is made for the age group 10 to 19, this being the only group with enough sera in each category to give reliable comparative results. From this table it may be seen that no significant differences as to protective power were found among persons who had or had not had clinically recognized poliomyelitis.

TABLE 7.—*Protection shown by sera from various donors in the age group 10 to 19 years* [1]

Classification of donors, age group 10–19 years	Number tested	Sera giving protection	
		Number	Percent
Poliomyelitis cases	6	5	83
Family contacts of cases	10	8	80
Orphanage children	20	18	90

[1] Suspected cases omitted.

TABLE 8.—*Protection shown by sera of persons in private urban dwellings and of persons in orphanages, age group 10 to 19 years*

Classification of donors, age group 10–19 years	Number tested	Sera giving protection	
		Number	Percent
Children in private urban dwellings [1]	17	11	65
Children in orphanages [2]	20	18	90

[1] 12 white, 5 colored. [2] 10 white, 10 colored.

In addition to age, it appears that another factor, related to frequency of contact among individuals, may have had an influence on the degree of protection shown by the sera tested. In table 8 persons of the age group 10 to 19 years are separated into two classes, those living in private dwellings in the city of Charleston, and those living in two orphanages, one for white and one for colored children. The number of sera tested is small and does not warrant making

generalizations, but it is interesting to note that the orphanage group showed appreciably more protection than the persons living in private homes.

RESULTS OBTAINED WITH DETROIT SERA

All the Detroit sera tested were obtained from cases of poliomyelitis. Of the 14 sera, 5 gave protection. Data were complete for only 10 of these sera, 3 being from persons under 10 years of age and 7 from persons in the age group 10 to 19 years. These figures are too small to permit analysis, and about the only statement to be made regarding this group of sera is that a minority of the specimens tested was capable of protecting mice against the Lansing strain of virus. Table 9 shows the results obtained with the Detroit sera.

TABLE 9.—*Poliomyelitis cases from Detroit, Mich., whose sera were tested for neutralizing antibodies against the Lansing strain of poliomyelitis in mice*

Patient	Race	Sex	Age	Onset date, 1939	Date of bleeding	Extent of involvement during acute stage [1]	Reaction of sera in neutralization tests
D. G.	C	F	6	Sept. 15	April 1940	Legs and abdominals	Protection.
N. P.	W	F	7	July 27	do	do	No protection.
P. R.	W	F	8	Aug. 13	do	Right leg	Do.
A. H.	C	F	10	July 13	do	Leg, abdominals, back	Questionable.
P. B.	W	M	10	Sept. 15	do	Right leg	No protection.
J. M.	W	M	11	do	do	Both arms, leg, back	Do.
R. M.	W	M	11	Sept. 11	do	Both arms	Do.
H. E.	W	M	14	Aug. 20	do	Both arms, abdominals	Do.
J. P.	W	M	14	August	do	Left leg	Protection.
M. R.	C	M	16	do	do	Right arm	No protection.
J. J.	(2)	(2)	(2)	(2)	do	(2)	Protection
H. J.	(2)	(2)	(2)	(2)	do	(2)	No protection.
J. K.	(2)	(2)	(2)	(2)	do	(2)	Protection.
A. V.	(2)	(2)	(2)	(2)	do	(2)	Do.

[1] Extent of residual involvement at time of bleeding not known.
[2] No data.

COMPARISON OF RESULTS WITH CHARLESTON AND DETROIT SERA

The sera from the Charleston cases gave protection in a higher proportion of instances than those from Detroit. This appears from the following comparison:

	Number tested	*Number giving protection*	*Percent giving protection*
Sera tested from Charleston cases	19	12	63
Sera tested from Detroit cases	14	5	36

The ages of all the Detroit cases are not known, but at least 7 of the 14 are known to be 10 or more years old; 53 percent of the Charleston cases were aged 10 or more.

DISCUSSION

Results of the serum-virus protection test on 83 human sera indicate that serum antibodies capable of neutralizing the Lansing strain of

poliomyelitis virus are widely prevalent, especially among older individuals. The results secured with mice appear to be more trustworthy than those usually secured with monkeys, since mice are more uniformly susceptible than monkeys besides being inexpensive and available in large numbers. The test is easily performed, the results consistent and usually clear-cut, and, insofar as results are available, they are in general agreement with neutralization results secured with human sera in monkeys. These considerations, together with the small amount of serum required for the test (0.45 cc.) should render it possible to follow serum immunity in groups of population from different localities and from infancy to adulthood and thus probably to clarify many epidemiological questions still awaiting solution, at least insofar as one strain of poliomyelitis is concerned.

SUMMARY

1. The mouse protection test, using human sera and the Lansing strain of poliomyelitis virus adapted to mice, gives results that are clear-cut and consistent.

2. An appreciable percentage (68.7+) of the human sera tested protected mice against this virus.

3. The individual's experience with clinically recognized poliomyelitis, or lack of it, did not determine the presence or absence in his blood serum of protective antibodies against the virus employed.

4. The percentage of sera giving protection increased with the age of the donors.

5. There was more protection shown by the sera of persons living in orphanages than by those of the same age group living in private urban dwellings.

6. A higher percentage of poliomyelitis sera tested from Charleston, S. C., gave protection than did those tested from Detroit, Mich.

ACKNOWLEDGMENT

We are indebted to Dr. Leon Banov, Miss Margaret S. Arey, and Mrs. Holmes Hazelton of Charleston, S. C., for invaluable personal assistance in the collection of blood in that city, to Dr. J. G. Molner for sending us the specimens from Detroit, Mich., and to Passed Assistant Surgeon A. G. Gillian for providing data relative to the Charleston cases.

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STUDIES ON TRICHINOSIS

XIV. A SURVEY OF MUNICIPAL GARBAGE DISPOSAL METHODS AS RELATED TO THE SPREAD OF TRICHINOSIS[1]

By WILLARD H. WRIGHT, *Chief, Division of Zoology, National Institute of Health, United States Public Health Service*

The relatively high incidences of the trichina parasite, *Trichinella spiralis*, in various population groups in the United States, as indicated by studies at the National Institute of Health and elsewhere, warrant the expenditure of some effort to determine the factors responsible for such a widespread distribution of this parasite. Some time ago, the writer (*1*) reported an incidence of trichinae of 16.3 percent in 3,000 diaphragm examinations in the National Institute of Health and summarized the findings in other post-mortem surveys in the United States which indicated an incidence of trichinae of 18 percent in 3,494 examinations when due allowance is made for differences in the techniques employed. Since that time Walker and Breckenridge (*2*) have reported finding the parasite in 33 of 100 persons coming to necropsy in Birmingham and Tuscaloosa, Ala.; Evans (*3*) has reported an incidence of 36 percent in 100 cases at Cleveland, Ohio; Hood and Olson (*4*) in Chicago found trichinae in 5.77 percent of 208 diaphragms examined by the digestion method and in 13.6 percent of 220 diaphragms examined by both the digestion and microscopic methods; while Sawitz (*5*) has reported a finding of trichina infection in 7 percent of 200 additional diaphragms examined at New Orleans. These findings, together with those from later examinations in the National Institute of Health, add confirmation to the results of previous surveys which showed that approximately 1 in every 6 persons examined was infected with the parasite.

Most of these surveys comprise samplings of the urban population, and persons residing in rural areas are very inadequately represented. In order to offset this great preponderance of urban material, we are now engaged in a survey designed to determine the incidence of the parasite in persons residing on farms or in villages of 1,000 population or less. To date, only 5, or 4.1 percent, of 122 such persons have been found positive for trichinae. While this represents a relatively small number of examinations, the incidence figure is lower than that obtained by us in any group of 100 individuals examined from the urban population and would seem to indicate that persons residing in rural areas are not as frequently exposed to trichinosis as are persons residing in urban areas. If future examinations bear out this conclusion, we would have the rather anomalous situation in which persons in rural areas raising their own pork supply would be less

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[1] Presented in abridged form before the 37th Annual Conference of State and Territorial Health Officers with the United States Public Health Service, Washington, D. C., April 24, 1939.

exposed to trichinosis than persons dependent on commercial sources for the pork which they consume. While any discussion of the reasons for such a situation would at this time be premature, it is not out of order to hazard an opinion that the relatively large number of garbage-fed hogs going on the market in cities may represent the answer to the increased exposure to trichinosis faced by the city dweller.

Hall (*6*) has aptly pointed out the role of the hog fed on raw garbage as a source of human trichinosis. Since the appearance of Hall's paper Schwartz (*7*) has reported further on the examination for trichinae of swine maintained on different types of feed. Of 2,847 diaphragms from hogs that had been fed garbage as collected, 286, or 10 percent, were infected with trichinae, the number of larvae in individual diaphragms ranging from 1 to 77,100. Of 3,799 diaphragms from so-called grain-fed hogs, 40, or 1 percent, were infected with trichinae, the number of larvae in the individual diaphragms ranging from 1 to 1,033. Schwartz (*8*) had previously reported on the examination of 1,860 swine fed on cooked garbage, of which only 0.59 percent were infected with trichinae. At the present time the evidence is overwhelmingly in support of the view that the hog fed on uncooked garbage is the chief source of human trichinosis.

For the reason that most of the garbage fed to swine originates in towns and cities, it seemed pertinent to inquire into the extent to which present practices in the disposal of municipal garbage are concerned in the dissemination of the trichina parasite.

RESULTS OF PREVIOUS SURVEYS

We were led to make this survey because of the difficulty of obtaining reliable information concerning the extent of the hog-feeding method of disposal of municipal garbage. The Municipal Index for 1930 (*9*) gave data on garbage collection and disposal in 557 cities of over 4,500 population, of which 216, or 38.8 percent, disposed of their garbage by feeding it to swine. Eddy (*10*) has recently stated that this method is the one practiced in the largest number of cases and Toquet (*11*) has estimated that 50 percent of cities with a population of 15,000 utilize the hog-feeding method of garbage disposal. Gillespie and Reinke (*12*) reported that in 1930, 162 of 242 cities in California were disposing of garbage by feeding it to swine. Conti (*13*) in 1930 stated that for 5 years previously none of the 44 cities in Los Angeles County, Calif., had used any method other than hog feeding for the disposal of their garbage. The magazine, Public Works (*14*), noted that for the year 1930, 49 percent of the cities reporting to it fed all or part of the garbage to hogs. The 1931 report of the United States Chamber of Commerce on refuse disposal in American cities (*15*) gave

data on the results of three surveys, including the Municipal Index survey mentioned above. A survey made in 1917 indicated that 35 percent of 610 reporting cities used the hog-feeding method of garbage disposal, while another survey made in 1925 indicated that 44 percent of 967 cities disposed of municipal garbage in this way.

NATURE AND EXTENT OF THE SURVEY

During the months of November and December 1938 and January 1939, letters were addressed to health officers in all cities of 10,000 population and over according to the 1930 census. The health officer was requested to indicate on a form supplied for that purpose the method of garbage disposal employed in his city and, in event that the garbage was fed to swine, whether it was fed on a municipally owned hog farm or by contractor, whether the garbage was fed raw or was cooked, and the number of garbage-fed hogs marketed during the calendar year 1937. As some cities employing sanitary methods of disposal give or sell municipally collected garbage to farmers for hog feed, effort was made to ascertain the number of tons of garbage disposed of in these ways. The questionnaire was designed to cover the disposal of municipally collected garbage only and did not refer to the disposal of hotel and restaurant garbage for the reason that in most cities and towns this refuse is collected by individuals who usually feed it to swine.

RESULTS OF THE SURVEY

Letters were addressed to health officers in 964 cities and replies were received from 764, or 79.3 percent, of these cities. Table 1 summarizes the results from the standpoint of the frequency of the methods employed, both as regards the use of single methods and as regards the use of multiple methods of disposal. Impending changes in methods of disposal were indicated in the replies from some cities. Three were changing from the fill and cover method to incineration, one from fill and cover to hog feeding, one from fill and cover to grinding and discharge into sewers, one from hog feeding to grinding and discharge into sewers, and one from hog feeding and fill and cover to incineration.

It will be noted that the hog-feeding method of disposal was used in the greatest number of cases followed in order by incineration, fill and cover, reduction, and by certain miscellaneous methods of disposal. A total of 296 cities disposed of municipal garbage entirely by feeding it to swine, while an additional 107 cities disposed of part of the garbage by feeding it to swine. Thus a total of 403, or 52.7 percent, of the 764 cities replying to the questionnaire disposed of municipally-collected garbage in whole or in part by feeding it to swine. Twenty-two of these cities maintained a municipal hog farm.

TABLE 1.—*Results of survey of garbage disposal methods in 764 of 964 cities with a population of 10,000 and over, showing number of cities using various single and multiple methods of disposal*

Methods of disposal	Number of cities
Single methods of disposal	
Incineration	107
Reduction	7
Fill and cover (including dump)	135
Hog feeding	296
Dumping at sea	2
Dumping in lake	1
Dumping in river	1
Multiple methods of disposal:	
Incineration and reduction	1
Incineration and fill and cover	16
Reduction and fill and cover	1
Hog feeding and incineration	38
Hog feeding, incineration, and fill and cover	4
Hog feeding and reduction	8
Hog feeding and fill and cover	57
Hog feeding and dumping at sea	2
Hog feeding and dumping in river	1
Hog feeding and grinding and discharge into sewers	2
Total	764

Replies to the questionnaire indicated that municipal garbage from only 24 of the 403 cities was cooked before its consumption by swine but even in some of these cities only a portion of the garbage was cooked.

Inasmuch as health officers seldom have direct supervision over refuse disposal, it was not expected that complete returns would be made in connection with the question asking for the number of garbage-fed hogs marketed during the calendar year 1937. However, 232 cities reported the marketing in that year of a total of 302,796 hogs fed on municipally-collected garbage; of these hogs, only 32,028 were fed on cooked garbage. Even if the former figure is approximately accurate, which it probably is not, it would in no way be indicative of the number of garbage-fed hogs marketed yearly in the United States, for the reason that it does not take into account estimates from cities not represented in this survey or the vast number of swine fed on hotel, restaurant, and privately-collected garbage.

In the majority of cities using the hog-feeding method of disposal, it is the practice usually to feed the garbage on a municipally-owned hog farm or to dispose of it through contractors who in turn feed it to swine. However, returns from the questionnaire indicated that a few cities having available sanitary methods of disposal indulged in the practice of giving or selling to numerous individual hog feeders a portion of the garbage collected by the municipality. Among these cities, Washington, D. C., having a reduction plant, gave away approximately three-fourths of the garbage to hog feeders and sent only one-fourth to the reduction plant. Boston, Mass., also having a reduction plant, furnished gratis to farmers approximately 15,000 tons, or about one-fourth of the amount of garbage collected by the

municipality. St. Louis, Mo., which discharges ground garbage into sewers, sold 26,150 tons to farmers for hog feed. Lastly, Philadelphia, Pa., using the reduction method of disposal, presented gratis to hog feeders 119,416 tons, over 70 percent of the total amount collected. While these cities have available methods of garbage disposal other than hog feeding, actually a varying percent of the garbage was fed to hogs during the calendar year 1937. Consequently, these cities have been included in the group of municipalities employing in part the hog-feeding method of disposal.

DISCUSSION

These results show that a surprisingly large percentage of cities included in the survey dispose of garbage by feeding it to swine and that this method is employed more frequently than is any other single method of disposal. While no reliable figures are available, it seems probable that this method is used as frequently, or even more frequently, by smaller communities in which revenue from taxation is not sufficient to provide for more sanitary methods of disposal. In the aggregate, American municipalities either directly or indirectly are probably the largest feeders of raw garbage to swine and would therefore appear to be chiefly responsible for the dissemination of trichinosis. Many hogs maintained on municipal garbage are slaughtered locally, and many cities are thus contributing indirectly to the ill health of their own citizens. We have been informed that many garbage feeders avoid marketing their hogs in federally inspected packing plants in order to obviate price differentials resulting from condemnations under Federal inspection for disease conditions, other than trichinosis, which are common in garbage-fed hogs. In uninspected plants, trichinous pork may go into products customarily eaten raw by the consumer, thus providing very dangerous avenues of infection.

It has been pointed out in a previous paper (*1*) that geographical areas in which many hogs are raised on garbage are the areas having the most clinical trichinosis. There is even some further correlation between the percentage of cities feeding garbage to hogs and the trichinosis morbidity rate. For instance, the Pacific Coast States, in which 82.8 percent of the cities concerned dispose of garbage by feeding it to swine, have the highest morbidity rate of any section. The New England States, with the next highest morbidity rate, lead all other geographical areas in the number of cities using the hog-feeding method of disposal. Table 2 presents the results of the present survey by States and geographical areas and shows the number and percentage of cities which use the hog-feeding method of garbage disposal.

Table 2.—*Results by States and geographical divisions of survey of garbage disposal methods in 764 of 964 cities of 10,000 population and over, showing distribution of cities using the hog-feeding method of disposal*

Division and State	Total cities with population of 10,000 and over	Number of replies received	Percent of cities replying	Number of cities in which municipal garbage is fed to swine	Percent of cities in which municipal garbage is fed to swine
NEW ENGLAND					
Maine	11	9		8	
New Hampshire	10	8		5	
Vermont	4	4		4	
Massachusetts	73	56		54	
Rhode Island	12	11		9	
Connecticut	31	20		12	
Total	141	108	76.6	92	85.2
MIDDLE ATLANTIC					
New York	69	52		12	
New Jersey	55	44		7	
Pennsylvania	92	66		13	
Total	216	162	75.0	32	19.8
EAST NORTH CENTRAL					
Ohio	59	51		29	
Indiana	34	28		20	
Illinois	58	46		20	
Michigan	40	34		22	
Wisconsin	27	19		8	
Total	218	178	81.7	99	55.6
WEST NORTH CENTRAL					
Minnesota	14	10		4	
Iowa	21	16		13	
Missouri	16	14		11	
North Dakota	4	3		2	
South Dakota	6	6		1	
Nebraska	8	6		3	
Kansas	20	14		14	
Total	89	69	77.5	48	69.6
SOUTH ATLANTIC					
Delaware	1	1		0	
Maryland	6	6		1	
District of Columbia	1	1		1	
Virginia	14	13		5	
West Virginia	10	8		1	
North Carolina	21	14		6	
South Carolina	9	8		1	
Georgia	15	13		3	
Florida	14	12		4	
Total	91	76	83.5	22	28.9
EAST SOUTH CENTRAL					
Kentucky	12	11		4	
Tennessee	8	7		2	
Alabama	14	12		1	
Mississippi	12	11		7	
Total	46	41	89.1	14	34.1
WEST SOUTH CENTRAL					
Arkansas	9	5		4	
Louisiana	8	6		2	
Oklahoma	15	12		9	
Texas	36	30		18	
Total	68	53	77.9	33	62.3

TABLE 2.—*Results by States and geographical divisions of survey of garbage disposal methods in 764 of 964 cities of 10,000 population and over, showing distribution of cities using the hog-feeding method of disposal*—Continued

Division and State	Total cities with population of 10,000 and over	Number of replies received	Percent of cities replying	Number of cities in which municipal garbage is fed to swine	Percent of cities in which municipal garbage is fed to swine
MOUNTAIN					
Montana	6	5		2	
Idaho	2	2		2	
Wyoming	2	1		0	
Colorado	8	6		6	
New Mexico	3	2		2	
Arizona	2	2		2	
Utah	3	1		1	
Nevada	1	0		0	
Total	27	19	70.4	15	78.9
PACIFIC					
Washington	15	12		6	
Oregon	6	5		4	
California	47	41		38	
Total	68	58	85.3	48	82.8
Grand total	964	764	79.3	403	52.7

The situation today plainly indicates that methods of garbage disposal have not kept pace with the marked improvements effected during recent years in other municipal sanitary services. While no effort has been made to obtain such information, it seems safe to assume that nearly all, if not all, of the cities utilizing the hog-feeding method of garbage disposal have sewage and water systems sufficiently adequate for the prevention of fecal-borne diseases. Many of them have food-inspection services and probably most of them have milk ordinances based on the standard ordinance of the United States Public Health Service or ordinances equivalent to that ordinance. Thus, most of these municipalities have probably provided adequate protection against most of the diseases spread through food or water; however, in the case of trichinosis they are not only failing to provide adequate safeguards but are contributing to the spread of infection.

The persistence of such an outmoded method of garbage disposal is accounted for in part by the revenue which many cities derive from such refuse. Some municipalities receive a sizable amount of income from the sale of garbage. Others, which merely furnish the garbage gratis to hog feeders, while not profiting directly, are relieved of the expense of disposal. With the present burden of taxation, any method of refuse disposal which represents a saving to the municipality appeals alike to the city official and the taxpayer. The general application of any suitable method or methods for the sterilization and processing of garbage so that its value as an animal food might be safely conserved would help solve the present problem. However,

the economic factor is not the factor of prime importance. With such things as the use of night soil as fertilizer, we have long since disregarded the economic factor in favor of benefits to community health.

The vociferous pressure brought to bear by the organized garbage feeder, who frequently is merely a proprietor of a piggery and in no sense a swine raiser or an agriculturist even though producing pork in competition with farmers who raise swine in a clean and sanitary manner, has probably helped to perpetuate the noxious practice of disposing of garbage by feeding it to swine. Recent attempts in at least two States to secure legislation looking to the control of trichinosis by restricting the practice of feeding uncooked garbage to swine have been blocked largely by organizations of persons engaged in this practice. There is no doubt that similar influences have been brought to bear on many city officials in the matter of the disposal of municipal garbage.

State and local health officials may well assume the leadership in remedying the present anomalous situation. State surveys would be desirable in ascertaining those cities, incorporated towns, and villages disposing of collected garbage by feeding it to swine. Effort should be made to encourage disposal by methods which are accordant with accepted public health standards. Until facilities are available for sanitary methods of disposal, it would be desirable for cities to include in contracts for garbage removal and disposal provisions for the adequate cooking of garbage before its consumption by swine. In those cities already employing sanitary methods of disposal but benefiting from garbage sold or furnished gratis to farmers and hog feeders, the public health aspects of the matter should be considered and effort made to curb such practices.

It is apparent from the present survey that archaic methods of garbage disposal are still widely employed and that improvements in this essential municipal function have lagged far behind those effected in other municipal sanitary services. Under present conditions, it would appear that little can be accomplished in the way of controlling trichinosis so long as our cities and towns continue their substantial contributions to the spread of this disease and serve as flagrant examples for others to do likewise.

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PATHOLOGIC HISTOLOGY OF EXPERIMENTAL VIRUS INFLUENZA IN FERRETS [1]

By T. L. Perrin and J. W. Oliphant, *Passed Assistant Surgeons, United States Public Health Service*

In 1933 Smith, Andrewes, and Laidlaw (*1*) reported on an acute respiratory infection experimentally produced in ferrets by the intranasal inoculation of influenza virus from human sources. Since that time ferrets have been used extensively for the study of influenza virus from both human and swine sources. However, reports in the literature on the pathologic alterations produced in ferrets by the inoculation of influenza virus are few in number and are limited to the study of changes in the respiratory system. The reports describing these pathologic changes are by Smith, Andrewes, and Laidlaw (*1*, *2*), Shope (*3*), Francis (*4*), Francis and Stuart-Harris (*5*), Brightman (*6*),

[1] From the Divisions of Pathology and Infectious Diseases, National Institute of Health.

and Dujarric de la Riviere and Cheve (7). Only two of these reports, (3) and (5), give much histopathologic detail.

The purpose of this experiment was to observe the histopathologic changes in the respiratory system of ferrets inoculated with human influenza virus, and to observe certain other organs for possible effects.

MATERIALS AND METHODS

Twenty-one young male ferrets, about 4 months old, with normal temperatures were inoculated on September 14, 1939, with 5 percent suspension of ferret lung and turbinates in 50-percent beef broth-normal saline. The virus used was the P.R. 8 strain which was supplied by Dr. Thomas Francis, Jr., and has been maintained in this laboratory by mouse passage for about 2 years. Before use, two ferret passages of the virus were made. The animal used in making the suspension for inoculation had been inoculated 3 days previously, had been febrile for 2 days, and had a temperature of 39.9° C. when killed with ether. Small to moderate-sized pneumonic areas were present in all lobes of both lungs. Portions of the lungs and turbinates were ground with an abrasive, suspended in broth-saline and centrifuged at 1,000 r. p. m. for 10 minutes. One and five-tenths cubic centimeters of the supernatant were dropped into the nostrils of each animal under ether anesthesia. All animals were febrile within 36 hours after inoculation.

Two uninoculated ferrets and one which had been inoculated intranasally with plain broth were used as controls.

Animals were killed for study by first anesthetizing deeply with ether, then allowing them to inhale Orth's solution dropped into both nostrils until respiration ceased. The thorax was opened, a ligature was placed around the upper border of the larynx, and about 30 cc. of Orth's solution was injected into the trachea so that the lungs were moderately distended. All organs to be used for study were then placed in Orth's solution.

Routine sections for study in all animals were made from the nose, larynx, trachea, lungs, heart, liver, spleen, kidneys, and adrenals. The sections from the nose were usually three in number and were cross sections cut in a transverse vertical plane from the anterior, mid, and posterior portions of the nose. Both upper and both lower lobes of the lungs were sectioned in each animal, and usually a section was taken from the right middle lobe. A portion of mediastinum was included in sections from the upper lobes, usually showing one or more mediastinal lymph nodes. Tissues were routinely stained with modified Romanowsky (8) and Van Gieson stains.

ANATOMIC NOTE

As a detailed description of the normal anatomy of the ferret nose has been given by Francis and Stuart-Harris, only a few further notes seem necessary in following a description of the pathologic changes found in the nose.

Only the respiratory type of mucosa is seen in the anterior portion of the nose. In the midportion the olfactory type of mucosa is seen in small to moderate areas on the roof and turbinates, while the remainder is respiratory. The posterior portion of the nose is divided into three compartments, two major upper compartments separated by the nasal septum, and a lower smaller compartment. The latter is nasopharynx and is lined by respiratory mucosa. The upper compartments, containing the posterior laminae of the turbinates, are covered almost completely by olfactory mucosa.

In our animals the supporting framework of the turbinates was entirely bony and calcified. This contrasts with Francis and Stewart-Harris' finding of a cartilaginous framework.

HISTOPATHOLOGY

Nasal lesions.—In general the inflammatory reaction was more marked and extensive in respiratory than in olfactory mucosa. In the anterior and midportions of the nose where respiratory mucosa is predominant, the inflammation was more severe on the turbinates and floor than on the roof and walls.

Bacteria were usually absent. Clumps of cocci were seen around a foreign body in only one section.

The exudate covering the mucosa varied in amount from animal to animal and was either muco-purulent or purulent. It was first seen in small amounts 24 hours after inoculation and was not present in animals killed after the fourteenth day.

One day after inoculation, changes in the nasal mucosa were confined to areas covered by respiratory epithelium and consisted of congestion and focal infiltration by small numbers of polymorphonuclears and lymphocytes.

By the end of the second day the inflammatory reaction was accentuated but was still confined to respiratory mucosa. There was a diffuse but irregular infiltration by moderate numbers of polymorphonuclears and fewer lymphocytes, the cells focally being more numerous in the epithelium than in the lamina propria. The epithelium over the floor, roof, and walls was largely intact, but in foci the cells were swollen, showed cytoplasmic oxyphilia and vacuolization, karyopyknosis and, rarely, desquamation. Over the turbinates, columnar ciliated epithelium was almost completely replaced by a single layer of flattened, deeply basophilic cells with small patches devoid of

epithelium. The lamina propria was congested, edematous, and focally there was extravasation of blood.

Ferrets killed on the third and fourth days showed involvement of both respiratory and olfactory mucosa. The cellular infiltration noted previously was increased, being dense in some areas. In portions of the nose where respiratory mucosa is usually found, intact columnar epithelium was seen only in small irregular patches on the lateral walls and roof. In other areas degenerative changes similar to those noted on the second day were seen, and, in addition, cytoplasmic or intercellular vacuoles often contained fragmenting leucocytes or small hyaline oxyphil globules. Where a single layer of flattened cells had covered most of the turbinates in the anterior and midportions of the nose on the second day, there was now a single or double layer of swollen fusiform to polyhedral cells. The inflammatory reaction in the olfactory mucosa varied considerably in amount from animal to animal. At least half of this type of mucosa was normal in every ferret, and in some over three-fourths was intact. In the patchy, small to moderate-sized areas of involvement there were necrosis and desquamation of the superficial epithelial cells, and the deeper cells were swollen, irregularly polyhedral and without polarity. Infiltrating polymorphonuclears were sometimes clumped in intercellular vacuoles and in the lumina of mucosal glands, some of which were dilated. Leucocyte infiltration was rarely as dense in the involved portions of the olfactory lamina propria as it was in the edematous and focally hemorrhagic lamina propria of the respiratory mucosa. The osseous laminae of the turbinates showed moderate periosteal proliferation, and focally polymorphonuclears were seen between the proliferating cells; this periosteal reaction was noted especially under respiratory mucosa.

During the fifth and sixth days the cellular infiltration of the mucosa was unchanged, but in the respiratory mucosa definite stratification of the polyhedral epithelial cells was taking place. In the lamina propria of both respiratory and olfactory mucosa a little fibroblast proliferation was seen focally, and small groups of subperiosteal osteoblasts and occasional osteoclasts were found adjacent to the osseous laminae of the turbinates.

In the animals killed from the seventh through the eleventh days, the cellular infiltration of the mucosa was decreased in amount, and while polymorphonuclears predominated in the epithelium, lymphocytes and plasma cells were slightly more numerous in the lamina propria Most of the respiratory mucosa was covered by stratified epithelium of transitional type, and focally the superficial cells were cuboidal. In the olfactory mucosa the basal layer of cells was almost entirely intact and arranged normally, but in patchy areas the superficial cells were loose, polyhedral, and irregularly arranged, and in an

FIGURE 1 —Portion of nasal turbinate, showing normal olfactory (above) and respiratory mucosa (× 250)

FIGURE 2 —Nasal turbinate, third day after inoculation Inflammatory reaction in respiratory mucosa Note the loss of epithelium (× 200)

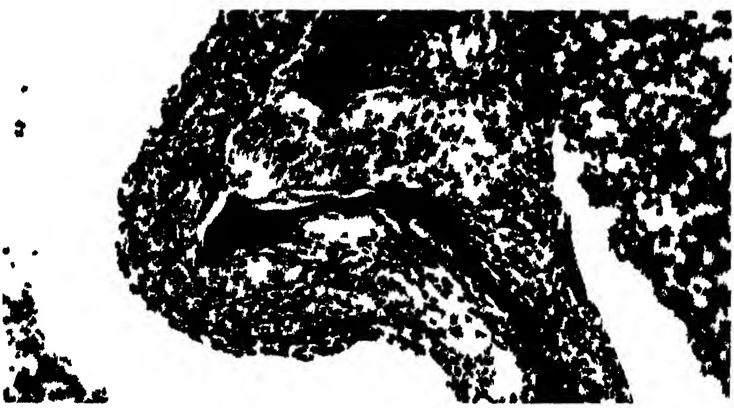

FIGURE 3 —Nasal turbinate, fifth day, respiratory mucosa Note more marked cell infiltration and beginning stratification of epithelium (× 200)

FIGURE 4.—Nasal turbinate, fourth day Inflammatory reaction in olfactory mucosa (X 260).

FIGURE 5.—Lung, one day after inoculation. Bronchiole in center shows partial loss of epithelium. Polymorphonuclears predominate in alveolar exudate (X 260).

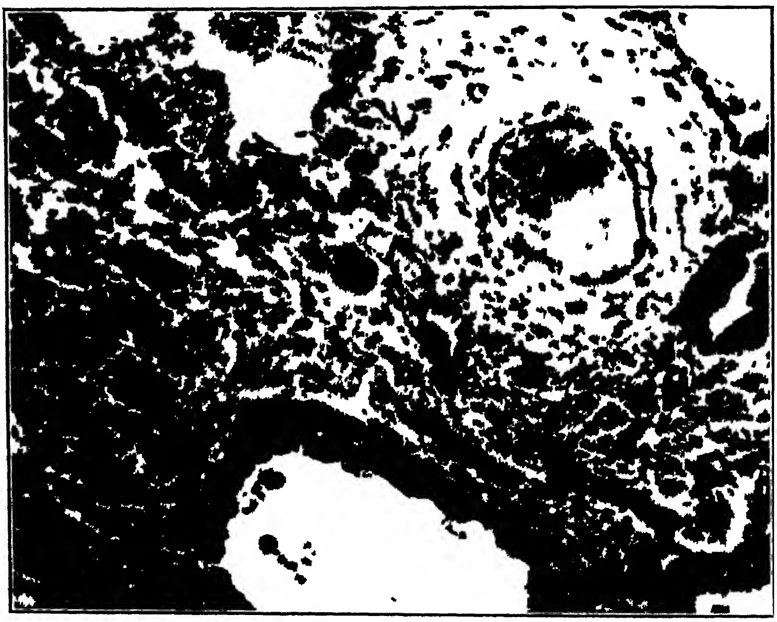

FIGURE 6.—Lung, sixth day. Marked proliferation of bronchial epithelium (below), and of monon cells lining alveoli (above). Note the loose cellular zone around the vessel (X 340).

occasional focus grouped into imperfect acini. The turbinate laminae were focally thickened beneath groups of osteoblasts, and occasional osteoclasts were seen in irregular surface depressions or within the laminae. A little fibrosis was seen in the lamina propria of the mucosa, particularly on the floor of the nose.

One ferret was killed on the fourteenth day, and the only changes from previous days were seen in the respiratory mucosa, where in a few areas the epithelium was stratified columnar in type and some of the superficial cells were distended with mucus.

By the nineteenth day most of the respiratory epithelium covering the turbinates and floor was stratified columnar, while that on the roof and walls was almost entirely normal. Goblet cells were numerous, and scattered polymorphonuclears were seen in the epithelium where they were occasionally clumped in vacuoles between cells or in occasional small acini. Olfactory epithelium was normal in appearance except for a few small areas where superficial cells were flattened. Focally, small to moderate numbers of lymphocytes and plasma cells were seen in the lamina propria, especially on the floor of the nose. In small areas periosteal proliferation was noted on the turbinate laminae, the latter showing irregular thickening beneath groups of osteoblasts. This thickening was especially prominent in the tips of the laminae where bulbous swellings were produced. In these thickened areas some of the osteoid cells within the laminae were round and swollen and were surrounded by small clear spaces.

Two ferrets were killed on the twenty-ninth day following inoculation. In these the respiratory epithelium on the walls and roof was normal except for occasional intercellular vacuoles containing a very few polymorphonuclears. The epithelium over the turbinates was a little irregular owing to focal stratification. The olfactory mucosa was normal. Irregular thickening of the turbinate laminae was similar to that described above.

Larynx and trachea.—Sections were taken from the larynx and from the midportion and lower end of the trachea of all animals. No lesions were seen in the larynx or midtrachea. In the lower end of the trachea small numbers of polymorphonuclears were seen in the mucosa in animals killed between the first and ninth days. Three of these ferrets also showed polymorphonuclear and lymphocyte infiltration around groups of tracheal glands, some of which contained pus.

Lungs.—The pathologic alterations in the lungs consisted of patchy pneumonic areas of small to moderate size occurring around inflamed medium-sized and small bronchi and bronchioles. The lesions were most numerous and extensive in the bases of the lower lobes, decreasing progressively upwards. Bacteria were not seen.

The lesions appeared early, and in ferrets killed 1 day after inoculation small numbers of polymorphonuclears were seen in mucoid

exudate in the main bronchi, and all lobes were congested. A small to moderate number of the medium and small bronchi and bronchioles contained a variable amount of purulent exudate; some contained only a few polymorphonuclears, while in others the lumina were filled with exudate. The walls of these bronchi and bronchioles were irregularly infiltrated by a small number of polymorphonuclears and lymphocytes, and focally the lining epithelial cells were swollen, vacuolated, and occasionally desquamated. Around these involved bronchi and bronchioles small to moderate-sized patches of alveoli contained small to moderate numbers of polymorphonuclears and fewer red blood cells, macrophages, and large mononuclear cells. Septal cells in these alveoli were swollen and polymorphonuclears were accumulated in the capillaries. A moderate number of medium-sized vessels and fewer medium-sized and small bronchi showed compact, thin to moderately thick collars of cells, chiefly lymphocytes. These peribronchial and perivascular collars were seen in apparently normal areas as well as in areas of inflammation.

By the second and third days the pneumonic process was more extensive, although the amount of involvement varied in different ferrets. Some of the pneumonic areas were larger than those seen on the first day, but many remained small. A moderate number of medium and small bronchi and bronchioles showed inflammatory reaction and contained more abundant purulent exudate than on the first day. In a few of these bronchi and bronchioles patchy areas of the mucosa were devoid of lining epithelium, and there was focal hyaline necrosis in the subjacent connective tissue. In others, groups of lining cells were degenerating and necrotic, while in other areas the cells were swollen and heaped. Slight to moderate polymorphonuclear and lymphocyte infiltration was seen in the bronchial walls and peribronchial connective tissue. In the pneumonic areas moderate numbers of polymorphonuclears and large mononuclear cells, together with a little fibrin, made up the exudate within alveoli; about half of the mononuclear cells showed phagocytic activity while the remainder had relatively large nuclei, prominent nucleoli, and scanty cytoplasm. In some alveoli large mononuclear cells lined the septa. A little edema fluid was seen in alveoli in a few pneumonic areas and beneath the pleura in some lung sections. Instead of compact perivascular and peribronchial collars made up of lymphoid cells as were seen on the first day, a moderate number of vessels and fewer bronchi were surrounded by a fairly wide zone in which lymphocytes, large mononuclear cells, and polymorphonuclears were loosely arranged in a meshwork of fibrillar basophilic material. In a moderate number of large bronchi, purulent exudate was present in small groups of mucous glands and moderate numbers of polymorphonuclears and lymphocytes were infiltrating the adjacent connective tissue.

In ferrets killed on the fourth, fifth, and sixth days the pneumonic process was slightly more extensive than that seen on previous days. In addition to changes previously seen in the medium and small bronchi and bronchioles, focal heaping of lining epithelium was prominent. The heaped-up cells were swollen, deeply stained, chiefly polyhedral, and at times showed cytoplasmic vacuolization; scattered mitoses were present. In the pneumonic areas macrophages and large mononuclear cells were slightly more numerous than polymorphonuclears. Large, deeply stained mononuclear cells lined some of the alveolar walls, particularly those walls adjacent to bronchi and vessels. Loose cellular zones around many vessels and a few bronchi were similar to those seen on previous days, and the inflammatory reaction around groups of mucous glands in large bronchi was also similar.

During the seventh, eighth, and ninth days the inflammatory changes in the lung became more prominently proliferative and less exudative. Purulent exudate in the bronchi and bronchioles was less in amount and showed a considerable admixture of large mononuclear cells. In most of the medium and small bronchi and bronchioles showing inflammatory change, focal heaping of the lining epithelial cells was marked. In a few of these bronchi and bronchioles a single layer of flattened epithelium covered areas of mucosa which had apparently been previously denuded of lining cells. In pneumonic areas mononuclear cells definitely predominated in most alveoli, and proliferating large mononuclear cells were prominent in the adventitial portions of vessels and bronchi, in interalveolar septae, and lining alveolar walls. In some alveoli syncytial groups of large mononuclear cells almost filled the lumina. In large bronchi some of the mucous glands were dilated and lined by swollen cells; others contained fragmenting polymorphonuclears and cellular debris. Lymphocytes predominated in a moderate cellular infiltration seen around these glands.

Ferrets killed on the eleventh and fourteenth days showed a definite shrinkage in the size of the pneumonic areas, and the lesions were less exudative than those noted previously. Proliferative changes were similar in type to those noted above, but they were less marked. Cuboidal and goblet lining epithelial cells were seen in small to moderate numbers in bronchi and bronchioles showing inflammatory reaction, and the goblet cells were numerous in all other bronchi.

By the nineteenth day goblet cells were numerous in the large and medium bronchi. In small bronchi and bronchioles there was still a little focal heaping of lining epithelial cells and small numbers of polymorphonuclears and lymphocytes were scattered between the epithelial cells and in the walls. A small number of alveoli contained occasional macrophages and polymorphonuclears, and in a very few, mononuclear

cells lined the septae. Cellular zones around a moderate number of vessels and fewer bronchi were compact, thin to moderately thick, and again composed chiefly of lymphocytes. A slight lymphocyte and polymorphonuclear infiltration was seen around groups of dilated mucous glands in a moderate number of large bronchi.

Of two ferrets killed on the twenty-ninth day, one showed focal foreign body reaction in the base of one lung. Occasional accumulations of lymphocytes were seen in peribronchial connective tissue in both animals and compact, thin to moderately thick lymphocyte zones were seen around some vessels and small bronchi.

Mediastinal lymph nodes.—Mediastinal lymph nodes were seen in sections from 15 of the 21 ferrets inoculated with influenza virus. In 7, small to moderate numbers of macrophages in dilated central sinuses showed marked erythrophagia. As a similar process was noted in one uninoculated ferret, no significance can be attached to this finding.

Spleen.—In 8 of the 21 ferrets inoculated with influenza virus and in the control ferret inoculated with plain broth, small circumscribed hemorrhagic lesions were noted focally in the spleen. These lesions were approximately of the same size and distribution as ellipsoids, and some were seen definitely involving portions of these structures. The lesions consisted of a central hyaline or fibrillar zone in which fragmented red blood cells and occasional elongated pyknotic nuclei were seen, and a peripheral zone where red blood cells were mingled with small to moderate numbers of polymorphonuclears. These lesions were inconstant, they occurred also in a control animal, and their appearance bore no relation to the lapse of time following inoculation; hence they were considered to be of no definite significance.

Kidneys.—In 12 of the inoculated animals and 1 of the controls, a variable amount of amorphous calcareous material was present in the lumina of loop and collecting tubules. It is probable that this finding, which is fairly common in some laboratory animals under various conditions, has no relation to the present experiment.

Heart, liver, and adrenals.—These organs were normal in all ferrets.

DISCUSSION

An acute inflammatory reaction in the nasal mucosa was produced in ferrets by the inoculation of human influenza virus. A ferret inoculated with plain broth and two uninoculated controls showed no nasal lesions. The pathologic changes described by Francis and Stuart-Harris (*5*) were essentially the same as those seen in this experiment, with only one exception. They found involvement of olfactory mucosa in a ferret inoculated with the W.S. strain of human influenza virus, but not in ferrets inoculated with the P.R. 8 strain. In this

experiment, lesions were regularly produced in the olfactory mucosa by the P.R. 8 strain. No explanation is offered for this difference.

The pathologic alterations in the lungs produced by influenza virus in this study consisted of acute bronchitis and bronchiolitis with an associated bronchopneumonia. The control ferret which was inoculated with plain broth showed a focal foreign body reaction in the lungs. The reaction occurred around fragments of vegetable tissue and did not resemble lesions produced by the virus. Two uninoculated ferrets showed no lesions. The type of lung lesions seen in this experiment differed from that described by Shope (*3*) in ferrets inoculated in a similar manner with swine influenza virus, and from that described by Francis (*4*) who used a human strain of virus. Both of these authors described a pneumonic process which was lobar in character and in which edema was a prominent feature. Shope apparently obtained the pulmonary lesions from the outset with the swine virus, while Francis was able to produce the lesions only after serial passage through ferrets. The human virus used in this experiment had been mouse adapted; it was then passed twice through ferrets before the experiment was begun. It is probable that lesions of the type described by Shope and by Francis would have been produced had our virus been adapted by preliminary serial passage through several more generations in ferrets.

The incomplete descriptions by other authors of lung lesions produced in ferrets by the inoculation of influenza virus do not permit close comparison with the results of this study. However, the pathologic alterations described appear to be of the same general nature.

SUMMARY

The intranasal inoculation of influenza virus in ferrets while under ether anesthesia produced definite pathologic alterations in the nose and lungs; these alterations have been described. No lesions which could be definitely attributed to the influenza virus were seen in mediastinal lymph nodes, heart, liver, spleen, kidneys, or adrenals.

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PROVISIONAL MORTALITY STATISTICS, BY STATES, FOR 1939

A continuation of favorable health conditions in the United States in 1939, as interpreted by the crude mortality rate, is evidenced by provisional mortality figures recently issued by the Bureau of the Census, Department of Commerce.[1]

According to provisional tabulations, there were 1,387,797 reported deaths in continental United States in 1939, an increase of 6,406 over the number reported in 1938. This figure gives a provisional crude death rate of 10.7 for 1939, as compared with a rate of 10.6 for 1938. This apparent increase, however, may be entirely due to the use of the 1938 estimate of population in computing the 1939 rate. It is quite probable that, when the current census of population is available and more nearly accurate estimates can be made for the late precensal years, the difference may entirely disappear, or even be reversed. In any case, mortality in the United States in 1939 may be said to be equally as favorable as that in 1938, which year recorded the lowest crude death rate in the history of the country.

The rates for the individual States for 1939 are based on population estimates for 1937, the last year for which State estimates have been made by the Census Bureau; and, therefore, they are probably higher, at least for some of the States, than they would be if computed on 1939 population estimates.

Twenty States show lower crude death rates in 1939 than in 1938, 21 States and the District of Columbia show higher rates, and 7 States show no change in rates from 1938 to 1939. On the basis of rates computed on the 1937 population estimates the greatest decreases are reported for Rhode Island, South Carolina, Georgia, North Carolina, Alabama, and Arizona, and the largest increases are recorded for the District of Columbia, Idaho, Iowa, and Montana. In a comparison of the 1938 and 1939 rates for individual States the lack of recent and more nearly accurate population estimates must be taken into consideration.

The highest crude death rates in 1939 are for Arizona (14.2 per 1,000 population), New Mexico (14.1), District of Columbia (13.2), and Florida (12.8). The lowest rates are for North Dakota (7.7), Oklahoma and South Dakota (8.0), and Arkansas (8.1). It must be remembered, however, that differences in crude death rates do not

[1] Vital Statistics—Special Reports, vol. 9, No. 45 (May 20, 1940), pp. 533–536.

necessarily indicate corresponding differences in health conditions. The age, sex, and racial distributions of the population are factors, among others, which affect the crude rate, and these distributions differ in the various States.

The accompanying tables present the number of deaths and crude death rates, by States, for the years 1935 to 1939, inclusive, and a summary of rates for the expanding death registration area, by years, from 1930 to 1939, inclusive. The death registration area did not include all of the States until 1933.

Number of deaths (exclusive of stillbirths) from all causes and death rates per 1,000 estimated population, by States, 1935–39

Area	1939 [1]	1938	1937	1936	1935	1939 [1]	1938	1937	1936	1935
United States	1, 387, 797	1, 381, 391	1, 450, 427	1, 479, 228	1, 392, 752	10.7	10.6	11.2	11.5	10.9
Alabama	28, 305	29, 536	30, 843	31, 153	28, 585	9.8	10.2	10.7	10.9	10.1
Arizona	5, 839	6, 002	6, 910	6, 551	6, 077	14.2	14.6	16.8	16.1	15.0
Arkansas	16, 521	16, 971	18, 304	18, 465	16, 176	8.1	8.3	9.0	9.1	8.1
California	77, 115	76, 187	80, 256	76, 094	72, 456	12.5	12.4	13.0	12.6	12.1
Colorado	12, 552	12, 615	13, 833	13, 674	13, 134	11.7	11.8	12.9	12.8	12.4
Connecticut	17, 695	17, 582	17, 892	17, 858	17, 659	10.2	10.1	10.3	10.3	10.3
Delaware	3, 170	3, 190	3, 290	3, 317	3, 208	12.1	12.3	12.6	12.8	12.5
District of Columbia	8, 200	7, 902	8, 727	9, 004	8, 483	13.2	12.7	13.9	14.7	14.3
Florida	21, 305	21, 024	20, 960	20, 953	20, 046	12.8	12.6	12.6	12.8	12.4
Georgia	31, 843	33, 783	34, 446	37, 208	34, 288	10.3	11.0	11.2	12.2	11.3
Idaho	4, 755	4, 545	4, 752	5, 014	4, 531	9.6	9.2	9.6	10.3	9.5
Illinois	86, 903	84, 760	87, 730	92, 806	85, 518	11.0	10.8	11.1	11.8	10.9
Indiana	39, 511	38, 573	40, 929	42, 470	39, 515	11.4	11.1	11.8	12.3	11.5
Iowa	26, 460	25, 623	26, 485	28, 432	26, 364	10.4	10.0	10.4	11.2	10.4
Kansas	18, 470	18, 583	19, 264	21, 674	20, 334	9.9	10.0	10.8	11.5	10.8
Kentucky	29, 509	29, 310	30, 899	32, 378	29, 370	10.1	10.0	10.6	11.2	10.3
Louisiana	24, 534	24, 767	25, 610	25, 974	23, 711	11.5	11.6	11.7	12.2	11.2
Maine	10, 803	10, 507	11, 465	11, 325	11, 024	12.6	12.3	13.4	13.3	13.0
Maryland	20, 830	20, 847	22, 083	21, 900	21, 182	12.4	12.4	13.2	13.1	12.7
Massachusetts	50, 917	49, 606	52, 248	52, 052	50, 237	11.5	11.2	11.8	11.8	11.5
Michigan	52, 023	50, 637	53, 472	54, 781	51, 050	10.8	10.5	11.1	11.5	10.8
Minnesota	26, 784	26, 179	26, 905	28, 630	26, 247	10.1	9.9	10.1	10.9	10.0
Mississippi	22, 647	22, 800	23, 856	24, 128	21, 339	11.2	11.3	11.8	12.0	10.6
Missouri	42, 591	42, 558	44, 974	48, 767	43, 201	10.7	10.7	11.3	12.3	11.0
Montana	5, 805	5, 684	6, 128	6, 255	6, 291	10.9	10.5	11.4	11.8	11.8
Nebraska	12, 189	11, 964	13, 199	13, 752	13, 181	8.9	8.8	9.7	10.1	9.7
Nevada	1, 256	1, 272	1, 322	1, 439	1, 324	12.4	12.6	13.1	14.4	13.4
New Hampshire	6, 301	6, 400	6, 528	6, 438	6, 532	12.4	12.5	12.8	12.7	13.0
New Jersey	43, 960	43, 831	45, 003	44, 959	43, 284	10.1	10.1	10.4	10.4	10.1
New Mexico	5, 937	5, 962	6, 422	6, 248	6, 272	14.1	14.1	15.2	14.8	14.9
New York	149, 507	147, 106	153, 772	153, 545	148, 462	11.5	11.4	11.9	11.9	11.5
North Carolina	31, 644	33, 599	33, 981	35, 630	33, 485	9.1	9.6	9.7	10.3	9.8
North Dakota	5, 427	5, 208	5, 440	5, 654	5, 899	7.7	7.4	7.7	8.0	8.4
Ohio	76, 933	74, 899	80, 189	80, 941	77, 356	11.4	11.1	11.9	12.1	11.5
Oklahoma	20, 378	19, 957	21, 313	23, 250	21, 091	8.0	7.8	8.4	9.2	8.4
Oregon	11, 788	11, 784	12, 341	12, 367	11, 430	11.5	11.5	12.0	12.2	11.3
Pennsylvania	108, 027	107, 282	114, 949	112, 711	108, 555	10.6	10.5	11.3	11.1	10.8
Rhode Island	7, 775	8, 276	8, 334	8, 126	7, 888	11.4	12.2	12.2	11.9	11.5
South Carolina	19, 274	20, 718	20, 540	21, 426	20, 353	10.3	11.0	11.0	11.5	11.1
South Dakota	5, 549	5, 482	5, 950	6, 157	6, 316	8.0	7.9	8.6	8.9	9.1
Tennessee	28, 726	29, 288	30, 232	32, 522	30, 002	9.9	10.1	10.5	11.4	10.6
Texas	60, 225	60, 208	65, 448	65, 803	61, 663	9.8	9.8	10.6	10.8	10.1
Utah	4, 713	4, 853	4, 989	5, 126	5, 066	9.1	9.4	9.6	9.9	9.8
Vermont	4, 546	4, 591	4, 981	4, 957	4, 777	11.9	12.0	13.0	13.0	12.7
Virginia	28, 641	29, 579	31, 119	32, 202	30, 358	10.6	10.9	11.5	12.1	11.5
Washington	18, 514	18, 528	19, 094	19, 356	18, 203	11.2	11.2	11.5	11.8	11.1
West Virginia	17, 494	17, 766	19, 190	19, 908	18, 340	9.4	9.5	10.3	10.9	10.1
Wisconsin	31, 425	30, 704	31, 978	33, 242	30, 694	10.7	10.5	10.9	11.4	10.6
Wyoming	2, 211	2, 235	2, 430	2, 401	2, 284	9.4	9.5	10.3	10.3	9.8

[1] 1939 figures are provisional.

NOTE.—United States rates for 1938 and 1939 are based on the 1938 estimated population; each State rate for 1938 and 1939 is based on the 1937 estimated population.

All data for the years prior to 1939 are final tabulations. The figures for 1939 are based on hand counts of death transcripts received by the Census Bureau from State offices of vital statistics. For the States from which the transmission of copies is complete, the provisional figures will agree closely with final tabulations. In the other States it may be expected that a few delayed certificates will be received before final tabulations are completed.

Death rate (number per 1,000 population) for registration area,[1] by years, 1900–1939

Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate
1939	[2] 10.7	1934	11.0	1929	11.9	1924	11.7	1919	12.9	1914	13.6	1909	14.4	1904	16.5
1938	10.6	1933	10.7	1928	12.1	1923	12.2	1918	18.1	1913	14.1	1908	14.8	1903	16.0
1937	11.2	1932	10.9	1927	11.4	1922	11.7	1917	14.3	1912	13.9	1907	16.0	1902	15.9
1936	11.5	1931	11.1	1926	12.3	1921	11.6	1916	14.0	1911	14.2	1906	15.7	1901	16.5
1935	10.9	1930	11.3	1925	11.8	1920	13.0	1915	13.6	1910	15.0	1905	16.0	1900	17.6

[1] In continental United States.
[2] Provisional.

COURT DECISION ON PUBLIC HEALTH

Death certificate as evidence of facts stated therein.—(New Jersey Court of Errors and Appeals; *Aitken* v. *John Hancock Mut. Life Ins. Co.*, 10 A.2d 745; decided January 25, 1940.) The statutes of New Jersey provided that in the execution of a death certificate the death and last sickness particulars should be supplied by the attending physician or, if there was no attending physician, by the county physician or coroner. It was also provided that, where a certificate or return of death was made by any person according to law, the original certificate, or a certified copy of such certificate or record thereof, should be received as prima facie evidence of the facts therein stated in all courts and places.

In an action on life insurance policies providing for extra indemnity for death by accident it appeared that there was an attending physician but that the death certificate was not made by him but by the acting county physician. Such certificate recited accidental injuries as the cause of death, but the court of errors and appeals stated that if it could disturb the finding on the weight of evidence it would do so because the proofs from the attending physician clearly demonstrated that death was from disease. The said court, in reversing the judgment of the lower courts in favor of the plaintiff, took the view that it was only a death certificate made in accordance with law that was prima facie evidence of the facts stated. It held that, as there was an attending physician able and competent to state the cause of death, the instant report was not made in accordance with the law and should not be given an effect to defeat the proper determination of the case.

DEATHS DURING WEEK ENDED JUNE 1, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended June 1, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	7,682	7,950
Average for 3 prior years	7,989	
Total deaths, first 22 weeks of year	199,673	199,346
Deaths under 1 year of age	461	490
Average for 3 prior years	508	
Deaths under 1 year of age, first 22 weeks of year	11,169	11,606
Data from industrial insurance companies:		
Policies in force	65,415,160	67,305,304
Number of death claims	9,899	10,089
Death claims per 1,000 policies in force, annual rate	7.9	7.8
Death claims per 1,000 policies, first 22 weeks of year, annual rate	10.4	11.5

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PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JUNE 8, 1940

Summary

Slight increases were reported for the current week for each of the 9 communicable diseases included in the following weekly table, with the exception of scarlet fever and typhoid; but both the current incidence and the cumulative totals were below the 5-year (1935–39) median expectancy for all of these diseases except influenza and poliomyelitis.

The number of cases of poliomyelitis increased from 47 for the preceding week to 58 for the current week, as compared with a 5-year median expectancy of 38 cases. Of the 58 cases reported currently, 40 occurred in 2 Pacific States—25 in Washington State (the same as last week), of which 23 occurred in Pierce County, 8 in Tacoma, and 15 cases in California (9 last week), of which 7 occurred in Los Angeles. The other cases were scattered, with not more than 3 cases reported by any one State.

The number of smallpox cases increased from 47 to 62, Wisconsin (11) and Minnesota (8) reporting the largest numbers. For the country as a whole the current incidence is less than one-third of the median expectancy.

Rocky Mountain spotted fever recorded a seasonal rise, with 25 cases reported as compared with 18 last week. Of these, 10 cases occurred in the eastern States (5 in Maryland), 1 case in Illinois, and 14 cases in the northwestern States (7 in Wyoming). Seven cases of Colorado tick fever were reported in Colorado and 2 cases in Utah. Of 25 cases of endemic typhus fever, 8 cases each were reported in Georgia and Texas and 1 case was reported in California.

For the current week the Bureau of the Census reports 8,579 deaths in 88 large cities, as compared with 7,682 for the preceding week and with a 3-year average of 7,773 for the corresponding week. The cause of the sharp increase in mortality in these cities for the current week—nearly 900 deaths, or approximately 12 percent—is not revealed.

Telegraphic morbidity reports from State health officers for the week ended June 8, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported cases may have occurred.

Division and State	Diphtheria: Week ended June 8, 1940	Diphtheria: Week ended June 10, 1939	Diphtheria: Median, 1935–39	Influenza: Week ended June 8, 1940	Influenza: Week ended June 10, 1939	Influenza: Median, 1935–39	Measles: Week ended June 8, 1940	Measles: Week ended June 10, 1939	Measles: Median, 1935–39	Meningitis, meningococcus: Week ended June 8, 1940	Meningitis, meningococcus: Week ended June 10, 1939	Meningitis, meningococcus: Median, 1935–39
NEW ENG.												
Maine	0	0	1	2	----	----	307	147	147	1	0	0
New Hampshire	0	0	0	----	----	----	3	13	30	0	0	0
Vermont	0	0	0	----	----	----	10	105	96	0	0	0
Massachusetts	5	3	3	----	----	----	1,341	1,120	634	1	2	2
Rhode Island	1	0	1	----	----	----	255	106	69	0	0	0
Connecticut	0	0	3	1	8	8	35	738	218	0	0	0
MID. ATL.												
New York	17	22	35	[1] 9	[1] 7	[1] 5	953	1,856	2,746	3	1	7
New Jersey [2]	10	13	14	4	----	5	1,256	51	605	0	1	2
Pennsylvania [2]	8	30	30	----	----	----	455	165	1,727	6	7	7
E. NO. CEN.												
Ohio	13	8	13	24	7	7	20	24	997	2	0	3
Indiana	4	7	7	11	11	11	13	8	155	2	1	2
Illinois [2]	28	27	30	11	18	18	188	40	457	0	0	5
Michigan [3]	4	10	10	2	1	1	832	283	283	2	1	1
Wisconsin	3	0	1	16	37	19	1,219	686	686	0	0	1
W. NO. CEN.												
Minnesota	1	1	3	2	1	1	88	166	311	0	0	1
Iowa	3	4	2	----	----	----	177	167	167	1	0	1
Missouri	3	9	14	----	1	10	6	8	56	0	0	1
North Dakota	0	0	1	14	18	7	2	17	11	0	0	0
South Dakota	3	0	1	1	2	----	3	117	8	0	0	0
Nebraska	1	2	4	----	----	----	16	132	132	0	0	0
Kansas	2	0	4	2	2	2	357	57	57	0	0	1
SO. ATL.												
Delaware [2]	0	0	1	----	----	----	2	20	22	0	0	0
Maryland [2 3]	1	1	5	2	2	2	18	225	105	1	0	3
Dist. of Col.[2]	3	0	7	1	----	----	2	181	93	0	1	1
Virginia	6	9	6	47	173	----	330	437	339	1	0	7
West Virginia [3]	6	7	7	6	7	17	26	6	46	2	0	3
North Carolina	0	7	8	1	2	1	111	296	106	0	0	1
South Carolina [4]	2	4	4	166	200	67	8	30	30	1	1	1
Georgia [4]	3	8	8	8	26	----	187	21	0	0	0	0
Florida [4]	0	7	3	----	5	2	62	73	19	0	0	2
E. SO. CEN.												
Kentucky	2	7	6	29	8	5	154	18	144	0	1	4
Tennessee	2	6	6	10	18	18	116	45	45	1	0	2
Alabama [4]	8	5	7	9	51	15	52	80	80	0	2	4
Mississippi [3]	6	8	6	----	----	----	----	----	----	0	0	0
W. SO. CEN.												
Arkansas	5	2	8	15	11	9	45	11	11	0	1	0
Louisiana [4]	3	11	11	14	7	7	5	74	13	1	0	1
Oklahoma [4]	4	5	5	10	28	28	8	159	63	1	1	1
Texas [4]	20	25	26	153	143	135	946	437	241	3	1	1
MOUNTAIN												
Montana [2]	0	0	1	----	4	2	86	154	97	0	0	0
Idaho [3]	2	1	0	----	----	1	16	23	11	0	0	0
Wyoming [2]	2	0	0	1	----	----	8	53	19	0	0	0
Colorado [2 5]	5	8	4	2	4	----	37	145	143	0	1	0
New Mexico [6]	1	0	5	----	2	2	38	11	47	0	2	0
Arizona	3	1	2	45	43	22	39	1	18	0	0	0
Utah [2 3 5]	0	1	0	----	4	----	363	105	50	0	1	0
PACIFIC												
Washington	1	4	2	----	----	----	263	1,053	209	0	0	0
Oregon [3]	10	1	1	8	13	13	230	69	60	0	0	0
California [4]	12	25	31	110	15	31	491	1,930	1,451	0	0	3
Total	222	289	335	731	877	512	11,209	11,660	11,669	20	25	88
23 weeks	7,254	9,556	11,359	165,405	147,900	137,512	183,643	312,854	312,854	[4] 870	1,077	3,295

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 8, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939		June 8, 1940	June 10, 1939	
NEW ENG.												
Maine	0	0	0	2	15	15	0	0	0	1	8	2
New Hampshire	0	0	0	1	0	1	0	0	0	0	0	0
Vermont	0	0	0	8	2	2	0	0	0	0	0	0
Massachusetts	1	0	0	180	121	197	0	0	0	0	1	1
Rhode Island	0	0	0	6	2	8	0	0	0	0	0	0
Connecticut	0	0	0	89	31	64	0	0	0	3	2	2
MID. ATL.												
New York	3	2	2	579	286	574	0	2	0	7	9	9
New Jersey [1]	1	0	0	264	102	102	0	0	0	0	1	2
Pennsylvania [3]	0	1	1	267	256	436	0	0	0	7	8	8
E. NO. CEN.												
Ohio	0	0	1	235	155	186	0	19	1	5	8	8
Indiana	0	0	0	30	62	62	2	13	7	9	1	8
Illinois [3]	2	1	1	590	202	302	4	24	15	3	8	6
Michigan [3]	0	0	0	255	842	276	2	18	1	3	5	8
Wisconsin	0	0	0	91	94	189	11	1	2	0	0	2
W. NO. CEN.												
Minnesota	0	1	0	49	43	70	8	3	8	0	0	0
Iowa	1	0	0	37	45	86	0	14	15	0	1	0
Missouri	0	0	0	18	20	67	6	8	8	2	7	7
North Dakota	0	0	0	4	5	20	0	0	6	1	2	0
South Dakota	0	0	0	16	7	12	5	10	8	0	0	0
Nebraska	0	1	0	13	8	28	1	1	4	1	2	2
Kansas	2	2	1	29	29	54	0	15	20	3	1	1
SO. ATL.												
Delaware [3]	0	0	0	3	2	6	0	0	0	0	0	0
Maryland [2] [3]	0	0	0	30	16	41	0	0	0	1	3	2
Dist. of Col. [2]	0	0	0	21	6	6	0	0	0	0	0	0
Virginia	0	0	0	39	9	16	0	0	0	5	2	8
West Virginia [3]	1	0	0	21	24	31	0	0	0	3	3	8
North Carolina	1	0	1	14	16	16	0	0	0	0	11	10
South Carolina [4]	0	27	0	4	3	0	0	0	0	2	7	7
Georgia [4]	0	1	0	5	5	5	0	6	0	6	14	14
Florida [4]	1	3	1	3	4	4	1	0	0	1	5	4
E. SO. CEN.												
Kentucky	0	1	0	37	16	20	0	1	1	9	17	10
Tennessee	3	0	0	32	26	17	2	32	0	0	3	11
Alabama [4]	0	0	1	8	6	5	3	0	1	3	4	5
Mississippi [3]	0	2	2	2	2	5	0	0	1	3	1	7
W. SO. CEN.												
Arkansas	0	0	0	2	2	2	2	1	0	9	12	6
Louisiana [4]	1	1	2	10	6	6	0	0	0	6	10	12
Oklahoma [4]	0	0	0	5	4	7	3	22	2	8	9	9
Texas [4]	0	4	3	19	22	41	3	3	3	13	16	26
MOUNTAIN												
Montana [3]	0	0	0	10	11	11	0	2	3	0	0	0
Idaho [3]	0	0	0	0	0	5	0	1	1	0	0	0
Wyoming [3]	0	0	0	2	0	24	0	0	4	2	0	0
Colorado [3] [5]	0	0	0	13	22	37	4	9	4	2	1	1
New Mexico [6]	1	0	0	9	7	15	0	1	0	2	0	4
Arizona	0	3	0	0	23	14	0	1	0	1	2	2
Utah [2] [3] [5]	0	0	0	7	14	15	4	0	0	0	2	0
PACIFIC												
Washington	25	0	0	23	28	26	0	1	4	2	31	1
Oregon [3]	0	0	0	11	14	22	0	4	4	2	0	1
California [4]	15	4	4	111	123	164	1	16	16	10	9	9
Total	58	54	38	3,099	2,245	4,011	62	228	215	130	221	221
23 weeks	602	565	506	107,264	100,053	149,164	1,607	7,876	6,898	2,088	2,941	2,941

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 8, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Whooping cough, Week ended June 8, 1940	Whooping cough, Week ended June 10, 1939	Division and State	Whooping cough, Week ended June 8, 1940	Whooping cough, Week ended June 10, 1939
NEW ENG.			SO. ATL.—continued		
Maine	12	24	Georgia [4]	11	25
New Hampshire	38	0	Florida [4]	4	15
Vermont	47	84	E. SO. CEN.		
Massachusetts	162	145	Kentucky	87	16
Rhode Island	10	55	Tennessee	50	54
Connecticut	49	101	Alabama [4]	14	104
MID. ATL.			Mississippi [3]		
New York	279	398	W. SO. CEN.		
New Jersey [2]	71	266	Arkansas	20	10
Pennsylvania [2]	302	303	Louisiana [4]	5	40
E. NO. CEN.			Oklahoma [4]	12	10
Ohio	145	113	Texas [4]	407	221
Indiana	50	70	MOUNTAIN		
Illinois [2]	91	248	Montana [2]	0	7
Michigan [3]	197	218	Idaho [2]	8	2
Wisconsin	62	125	Wyoming [2]	6	0
W. NO. CEN.			Colorado [2] [5]	21	44
Minnesota	29	34	New Mexico [6]	45	9
Iowa	19	26	Arizona	29	14
Missouri	15	8	Utah [2] [3] [5]	174	68
North Dakota	15	18	PACIFIC		
South Dakota	3	2	Washington	65	25
Nebraska	22	31	Oregon [2]	41	27
Kansas	54	26	California [4]	431	166
SO. ATL.			Total	3,464	3,555
Delaware [2]	4	10	23 weeks	73,248	90,631
Maryland [2] [3]	122	31			
Dist. of Col.[2]	5	25			
Virginia	59	54			
West Virginia [3]	73	27			
North Carolina	86	237			
South Carolina [4]	10	63			

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended June 8, 1940, 25 cases, as follows: New Jersey, 1; Pennsylvania, 1; Illinois, 1; Delaware, 2; Maryland, 5; District of Columbia, 1; Montana, 1; Idaho, 1; Wyoming, 7; Colorado, 2; Utah, 1; Oregon, 2.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended June 8, 1940, 25 cases, as follows: South Carolina, 8; Georgia, 8; Florida, 1; Alabama, 2; Louisiana, 2; Texas, 8; California, 1. Information has been received that diagnosis was changed on 1 case reported as typhus fever in Oklahoma for the week ended June 1 and published in the Public Health Reports of June 7, 1940, p. 1049.
[5] Colorado tick fever, week ended June 8, 1940, 9 cases, as follows: Colorado, 7; Utah, 2.
[6] Only 1 case of meningococcus meningitis occurred in New Mexico for the week ended May 18, 1940, instead of 19 cases, as published in the Public Health Reports of May 24, p. 946.

PLAGUE INFECTION IN FLEAS AND GROUND SQUIRRELS IN WASHINGTON

IN FLEAS FROM GROUND SQUIRRELS IN LINCOLN COUNTY

Under dates of May 28 and 29, 1940, Surgeon L. B. Byington reported plague infection proved in a pool of 105 fleas from 21 ground squirrels (*C. washingtoni*), and in a pool of 159 fleas from 29 ground squirrels of the same species, shot May 14 on 2 ranches 12 and 14 miles east of Odessa, Lincoln County, Wash.

IN FLEAS AND GROUND SQUIRREL IN SPOKANE COUNTY

Under dates of May 27 and 29, 1940, Surgeon L. B. Byington reported plague infection proved in tissue and in a pool of 36 fleas from 1 ground squirrel (*C. columbianus*), found dead May 21 in Turnbull Slough Game Refuge, near Cheney, and in a pool of 72 fleas from 21 ground squirrels of the same species shot May 21 on a ranch 5 miles east of Cheney, Spokane County, Wash.

SUMMARY OF MONTHLY REPORTS FROM STATES

Cases reported for the quarter January–March 1940

(Diseases covered by weekly telegraphic reports not included)

Division and State	Chickenpox	Dysentery, amoebic	Dysentery, bacillary	Dysentery, unspecified	Encephalitis, epidemic or lethargic	German measles	Hookworm disease	Malaria	Mumps	Ophthalmia neonatorum	Pellagra	Puerperal septicemia	Rabies in animals	Rabies in man	Septic sore throat	Trachoma	Tularaemia	Undulant fever
NEW ENG.																		
Maine	890					86			55						14			6
New Hampshire	185								117						2			
Vermont	462					11			224						1			8
Massachusetts	5,504	1	111		3	152		1	2,096	203	3		33		82	5		11
Rhode Island	439					11			502				16		72			3
Connecticut	2,605		7		2	20		1	1,263	1					100	1		7
MID. ATL.																		
New York	11,347	14	112		18	402		39		[1] 16			[1] 34		513		1	57
New Jersey	6,087	7			3	134			3,770	43			101		59	1	1	10
Pennsylvania	13,101	1	2		3	156			3,621	10	2					1	32	27
E. NO. CEN.																		
Ohio	5,258				4	51		2	2,002		1	4			70	7	14	20
Indiana	1,014		2		4			2	2,575				68		23	11	37	9
Illinois	6,145	21	18		8	96		31	1,549	8	1		68		38	44	113	26
Michigan	6,835	2	4		1	127		9					2		319	2	1	30
Wisconsin	8,610	1			1	92		2	4,557						64		7	19
W. NO. CEN.																		
Minnesota	2,684	7	1		1					1	1		11		34	1	1	18
Iowa	771	1			8	25		2	1,272		1		2		29		46	61
Missouri	378	1	3					9	380						26	40	43	3
North Dakota	450					1			711						2	6		2
South Dakota	372								44						25	18		1
Nebraska	335								605						1			10
Kansas	1,858	1	1		7	60		3	938		2				138	2	12	25

[1] Exclusive of New York City.

Cases reported for the quarter January–March 1940—Continued

Division and State	Chickenpox	Dysentery, amoebic	Dysentery, bacillary	Dysentery, unspecified	Encephalitis, epidemic or lethargic	German measles	Hookworm disease	Malaria	Mumps	Ophthalmia neonatorum	Pellagra	Puerperal septicemia	Rabies in animals	Rabies in man	Septic sore throat	Trachoma	Tularaemia	Undulant fever
SO. ATL.																		
Delaware	302								10	8								1
Maryland	1,647	1	16	1	2	25			132	1	1				106		16	10
District of Columbia	448	1									1							2
Virginia	971	3	200					6	156		23				542	4	23	4
West Virginia	579		1		1			1	36						39		3	1
North Carolina	1,726					21		16			5				25		4	5
South Carolina	362	1			8	12	548	804	128	7	283		47				8	11
Georgia	559	18	12	1			7,328	123	487		47	2			262	2	40	21
Florida	1,241	4				4	3,775	24	86		38		9		14		5	7
E. SO. CEN.																		
Kentucky	1,122	5	8		5	343			785		2				182	35	28	2
Tennessee	748	4	6			97	23	56	197	7	34	7	1		137		41	9
Alabama	403	1			2	141		204	213	2	45		49	1			3	10
Mississippi	1,402	374	716				1,648	3,026	1,222	26	716	99	22			30	7	6
W. SO. CEN.																		
Arkansas	294	13	5		2	4	28	204	130	3	119	8	52		375	45	14	4
Louisiana	225	7			2		12	15	38	1	6		30		11	3	17	7
Oklahoma	291	3	15		1			97	145		28		14		231	301	27	27
Texas	2,772	21	90		11			663	465	4	253		6			11	10	72
MOUNTAIN																		
Montana	677				14	2			606						24	61	1	2
Idaho	296				1	85			171						26			2
Wyoming	280					36			435						3		1	4
Colorado	636	2	7		5				2,164						53			3
New Mexico	441	4	3			3		2	234		8	3	12		13	13	2	3
Arizona	516			133	2	23		8	791		4					186	1	7
Utah	1,350			1		29			586						56	2	4	1
Nevada	106								3									

PACIFIC																		
Washington	2,089				3	61			532			1	18		10	7		7
Oregon	823	6						1	734				3		7	1		1
California	8,044	43	98		10	338	12	16	4,633	2	11		95	1	29	68	1	49
Total	105,680	568	1,435	136	152	2,648	13,352	5,367	41,420	338	1,635	119	693	2	3,757	913	564	631
Alaska	24											1			46			
Hawaii	204	33				14	46	1	141	2					1	4		
Puerto Rico [2]	36			173					5	10	3	13						

Division and State	Actinomycosis	Anthrax	Botulism	Dengue	Food poisoning	Granuloma, coccidioidal	Leprosy	Psittacosis	Rat bite fever	Relapsing fever	Tetanus	Trichinosis	Vincent's infection	Weil's disease
NEW ENG.														
Maine													16	
New Hampshire														
Vermont													34	
Massachusetts							1				2	6		
Rhode Island												1		
Connecticut											3	8		
MID. ATL.														
New York		2	1								11	98	[1] 70	
New Jersey		2										8		
Pennsylvania		9						1				9		
E. NO. CEN.														
Ohio											2	4		
Indiana							1				1			
Illinois	4						2				8		56	
Michigan											2	4	56	10
Wisconsin														
W. NO. CEN.														
Minnesota	1													
Iowa														
Missouri							1		1			1		
North Dakota													2	
South Dakota														
Nebraska														
Kansas											3		31	

[1] Exclusive of New York City.

[2] Reports for January and February only.

Cases reported for the quarter January–March 1940—Continued

Division and State	Actinomycosis	Anthrax	Botulism	Dengue	Food poisoning	Granuloma, coccidioidal	Leprosy	Psittacosis	Rat bite fever	Relapsing fever	Tetanus	Trichinosis	Vincent's infection	Weil's disease
SO. ATL.														
Delaware														
Maryland													19	
District of Columbia														
Virginia											3			
West Virginia														
North Carolina													31	
South Carolina				8							1			
Georgia											2			
Florida											1		12	
E. SO. CEN.														
Kentucky													54	
Tennessee											3		138	
Alabama											9			
Mississippi				1										
W. SO. CEN.														
Arkansas											2			
Louisiana		1					3				8			
Oklahoma													56	
Texas				3			1			4				
MOUNTAIN														
Montana														
Idaho													2	
Wyoming													1	
Colorado														
New Mexico	1													
Arizona														
Utah		1												
Nevada														
PACIFIC														
Washington			1		9						1		4	
Oregon													14	
California		2	8		158	14	1				10	15		
Total	6	17	10	12	167	14	10	1	1	4	72	154	596	10
Alaska													1	
Hawaii							12				5	1		1
Puerto Rico [1]											[2] 26		2	

[1] Reports for January and February only.

[2] 4 cases of infantile tetanus included.

WEEKLY REPORTS FROM CITIES

City reports for week ended May 25, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	135	67	81	5,584	500	1,828	20	391	29	1,223	-------
Current week [1]	70	44	12	8,538	367	1,949	0	357	13	1,055	-------
Maine:											
Portland	0	------	0	114	4	0	0	0	0	2	28
New Hampshire:											
Concord	0	------	0	0	1	0	0	1	0	0	16
Manchester	0	------	0	0	0	0	0	0	0	0	14
Nashua	0	------	0	1	2	0	0	0	0	0	7
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	0	10
Rutland	0	------	0	0	0	0	0	0	0	0	6
Massachusetts:											
Boston	0	------	0	209	17	54	0	3	0	78	184
Fall River	0	------	0	63	2	1	0	1	0	5	30
Springfield	0	------	0	1	1	7	0	4	0	5	28
Worcester	4	------	0	75	3	9	0	0	0	0	48
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	11
Providence	0	1	0	147	1	4	0	1	0	7	63
Connecticut:											
Bridgeport	0	------	0	1	1	4	0	0	0	1	21
Hartford	0	------	0	1	3	9	0	1	0	4	26
New Haven	0	1	0	0	1	8	0	1	0	2	40
New York:											
Buffalo	0	------	0	1	5	20	0	4	0	7	133
New York	19	7	0	337	74	632	0	67	2	81	1,481
Rochester	0	1	0	4	8	13	0	0	0	10	68
Syracuse	0	------	0	0	1	7	0	1	0	14	50
New Jersey:											
Camden	2	------	0	0	1	15	0	1	0	1	24
Newark	0	2	0	508	7	22	0	3	0	20	123
Trenton	0	------	0	0	1	[illegible]	0	1	0	3	32
Pennsylvania:											
Philadelphia	1	2	1	171	16	125	0	36	1	34	491
Pittsburgh	4	------	2	3	4	27	0	2	1	10	159
Reading	0	------	0	1	1	0	0	0	0	12	20
Scranton	0	------	------	0	------	1	0	------	0	0	------
Ohio:											
Cincinnati	2	------	0	1	7	17	0	7	1	36	122
Cleveland	0	7	0	5	9	51	0	11	0	42	178
Columbus	1	------	0	0	4	13	0	1	0	5	85
Toledo	0	------	0	3	4	50	0	5	0	5	63
Indiana:											
Anderson	0	------	0	0	0	0	1	0	0	0	8
Fort Wayne	1	------	1	5	4	0	0	2	0	4	33
Indianapolis	0	------	0	1	8	23	0	4	0	13	101
Muncie	0	------	0	0	3	0	0	1	0	0	15
South Bend	0	------	0	0	3	0	0	0	0	1	12
Terre Haute	------	------	------	------	------	------	------	------	------	------	------
Illinois:											
Chicago	7	------	0	98	33	513	0	38	0	32	745
Elgin	0	------	0	1	1	0	0	0	0	1	7
Moline	0	------	0	5	0	2	0	0	0	0	7
Springfield	1	------	0	2	0	8	0	0	0	0	22
Michigan:											
Detroit	------	------	------	------	------	------	------	------	------	------	------
Flint	0	------	0	5	2	15	0	0	0	8	23
Grand Rapids	0	------	0	10	1	8	0	0	0	19	24
Wisconsin:											
Kenosha	0	------	0	39	0	1	0	0	0	1	6
Madison	0	------	0	10	0	0	0	0	0	4	11
Milwaukee	0	------	0	190	3	28	0	5	0	4	116
Racine	0	------	0	1	0	2	0	0	0	1	20
Superior	0	------	0	68	0	1	0	0	0	1	6

[1] Figures for Barre, Terre Haute, and Detroit estimated; reports not received.

City reports for week ended May 25, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	9	1	3	0	0	0	0	23
Minneapolis	0	------	0	2	7	23	0	5	0	13	97
St. Paul	0	------	0	5	4	8	0	1	0	4	65
Iowa:											
Cedar Rapids	0	------	------	32	------	1	0	------	0	0	------
Davenport	0	------	------	14	------	4	0	------	0	1	------
Des Moines	1	------	0	31	0	13	4	0	0	0	34
Sioux City	0	------	------	1	------	3	0	------	0	0	------
Waterloo	1	------	------	0	------	2	0	------	0	1	------
Missouri:											
Kansas City	1	------	0	5	6	8	0	6	0	1	89
St. Joseph	0	------	0	0	2	1	0	0	0	1	20
St. Louis	2	4	2	7	2	20	0	7	0	11	175
North Dakota:											
Fargo	0	------	0	0	1	0	0	0	1	0	9
Grand Forks	0	------	------	0	------	0	0	------	0	0	------
Minot	0	------	------	0	------	2	0	------	0	0	------
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	1	------
Nebraska:											
Omaha	0	------	0	6	8	4	0	1	0	6	52
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	1
Topeka	0	------	0	24	1	2	0	0	0	2	15
Wichita	1	------	0	7	5	3	0	0	0	7	24
Delaware:											
Wilmington	1	------	0	0	2	2	0	1	0	2	24
Maryland:											
Baltimore	2	1	1	8	7	11	0	14	0	92	221
Cumberland	0	------	0	0	0	1	0	0	0	0	14
Frederick	0	------	0	0	0	0	0	0	0	0	4
Dist. of Col.:											
Washington	2	------	0	4	9	26	0	17	0	5	165
Virginia:											
Lynchburg	0	------	0	0	8	0	0	1	0	10	11
Norfolk	0	6	0	53	3	2	0	1	0	1	31
Richmond	0	------	1	4	8	2	0	1	0	0	44
Roanoke	1	------	0	29	0	1	0	0	0	0	12
West Virginia:											
Charleston	0	------	0	1	0	1	0	0	0	1	19
Huntington	0	------	------	0	------	2	0	------	1	0	------
Wheeling	0	------	------	1	------	1	0	------	0	0	------
North Carolina:											
Gastonia	0	------	------	0	------	0	0	------	0	0	------
Raleigh	0	------	0	1	0	0	0	0	0	3	14
Wilmington	0	------	0	0	1	1	0	0	0	0	7
Winston-Salem	0	------	0	2	0	3	0	3	0	0	17
South Carolina:											
Charleston	0	3	0	1	1	0	0	1	0	0	17
Florence	0	------	0	0	1	0	0	0	0	0	7
Greenville	0	------	0	0	1	0	0	0	0	1	4
Georgia:											
Atlanta	0	------	0	4	1	1	0	5	2	0	73
Brunswick	0	1	0	0	1	0	0	0	0	0	9
Savannah	0	1	0	0	3	1	0	0	0	0	29
Florida:											
Miami	0	1	0	0	1	0	0	0	0	0	30
Tampa	0	------	0	69	1	1	0	0	0	2	22
Kentucky:											
Ashland	0	------	0	0	0	0	0	0	0	1	5
Covington	0	------	0	10	1	4	0	3	0	0	11
Lexington	0	------	0	35	2	2	0	0	0	4	16
Tennessee:											
Knoxville	0	1	0	2	1	3	0	2	0	0	33
Memphis	0	1	1	25	1	20	0	4	0	20	59
Nashville	0	------	0	2	5	2	0	1	0	1	52
Alabama:											
Birmingham	0	4	0	4	2	2	0	4	0	4	59
Mobile	0	------	1	2	1	0	0	0	0	2	24
Montgomery	0	1	------	2	------	0	0	------	0	0	------
Arkansas:											
Fort Smith	0	1	------	0	------	1	0	------	0	0	------
Little Rock	0	1	0	1	6	1	0	1	0	1	7
Louisiana:											
Lake Charles	0	------	0	0	0	0	0	0	0	0	3
New Orleans	1	------	0	1	12	5	0	13	2	51	116
Shreveport	0	------	0	0	2	0	0	1	0	0	35

City reports for week ended May 25, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oklahoma:											
Oklahoma City	0	------	0	0	3	3	0	0	1	0	30
Texas:											
Dallas	0	------	0	507	4	3	0	3	0	28	65
Fort Worth	0	------	0	0	0	2	0	1	0	28	50
Galveston	0	------	0	0	2	0	0	0	0	2	18
Houston	2	------	0	9	4	2	0	8	0	2	80
San Antonio	2	------	0	7	6	0	0	5	0	10	70
Montana:											
Billings	0	------	0	0	0	0	0	0	0	0	6
Great Falls	0	------	0	30	1	2	0	0	0	0	7
Helena	0	------	0	0	0	0	0	0	0	0	2
Missoula	0	------	0	0	0	1	0	0	0	0	8
Idaho:											
Boise	0	------	0	2	1	0	0	1	0	0	12
Colorado											
Colorado Springs	1	------	0	2	0	0	0	1	0	0	18
Denver	9	------	0	24	5	9	0	1	0	1	81
Pueblo	0	------	0	4	0	2	0	0	0	0	7
New Mexico:											
Albuquerque	2	------	0	1	0	0	0	1	0	7	7
Utah:											
Salt Lake City	0	------	0	264	1	2	0	1	0	110	26
Washington:											
Seattle	0	------	1	167	2	7	0	6	0	13	100
Spokane	0	------	0	5	0	2	0	1	0	2	32
Tacoma	0	------	0	2	0	6	0	1	0	1	37
Oregon:											
Portland	1	1	0	82	5	1	0	5	1	11	100
Salem	0	------	------	1	------	0	0	------	0	0	------
California:											
Los Angeles	1	5	0	21	7	19	0	22	1	55	333
Sacramento	1	------	0	9	1	1	0	5	0	17	33
San Francisco	0	1	1	12	3	11	0	5	1	33	169

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
New York:			
Buffalo	0	2	0
New York	1	0	1
Indiana:			
Indianapolis	1	0	0
Michigan:			
Flint	1	0	0
Louisiana:			
New Orleans	1	0	1
Shreveport	0	1	0
Oklahoma:			
Oklahoma City	0	0	1
Washington:			
Tacoma	0	0	8
California:			
Los Angeles	0	0	8
San Francisco	1	0	0

Encephalitis, epidemic or lethargic.—Cases: New York, 4; Pueblo, 1; San Francisco, 1.
Pellagra.—Cases: Atlanta, 1; Mobile, 1; Sacramento, 1; San Francisco, 2.
Typhus fever.—Cases: New York, 5.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended May 11, 1940.—During the week ended May 11, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			2	5	5					12
Chickenpox		1	1	254	434	26	35	2	73	826
Diphtheria				12		4	1			17
Influenza	4	2			21	1			9	37
Lethargic encephalitis							1			1
Measles		4	1	135	475	452	283	6	102	1,458
Mumps				24	355	4			12	395
Pneumonia		4			14	4	1		15	38
Poliomyelitis					1	1	1			3
Scarlet fever		3	2	130	137	8	6	17	6	309
Tuberculosis	2	2	13	86	85	25	1			164
Typhoid and paratyphoid fever			3	9	5	1	1			19
Whooping cough		7	2	109	91	36	28	6	28	307

ITALY

Communicable diseases—4 weeks ended February 25, 1940.—During the 4 weeks ended February 25, 1940, cases of certain communicable diseases were reported in Italy as follows:

Disease	Jan. 29–Feb. 4	Feb. 5–11	Feb. 12–18	Feb. 19–25
Anthrax	11	6	8	6
Cerebrospinal meningitis	57	82	71	72
Chickenpox	329	339	398	439
Diphtheria	630	552	668	629
Dysentery (amoebic)	8	13	12	17
Dysentery (bacillary)			1	
Hookworm disease	21	15	29	34
Lethargic encephalitis		1	2	1
Measles	1,116	1,246	1,362	1,522
Mumps	346	411	479	499
Paratyphoid fever	49	45	33	33
Pellagra	2		1	
Poliomyelitis	18	12	17	13
Puerperal fever	21	22	16	25
Scarlet fever	212	187	232	236
Typhoid fever	209	224	193	202
Undulant fever	67	84	73	90
Whooping cough	410	375	341	353

JAMAICA

Communicable diseases—4 weeks ended May 11, 1940.—During the 4 weeks ended May 11, 1940, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	2	27	Poliomyelitis		1
Diphtheria	4	3	Puerperal sepsis		1
Dysentery	4	13	Tuberculosis	38	93
Erysipelas	1	1	Typhoid fever	5	66
Leprosy		2			

SWEDEN

Notifiable diseases—March 1940.—During the month of March 1940, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	4	Scarlet fever	3, 526
Diphtheria	20	Syphilis	26
Epidemic encephalitis	1	Typhoid fever	11
Gonorrhea	673	Undulant fever	9
Paratyphoid fever	4	Weil's disease	7
Poliomyelitis	13		

YUGOSLAVIA

Communicable diseases—4 weeks ended April 21, 1940.—During the 4 weeks ended April 21, 1940, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	19	3	Paratyphoid fever	7	
Cerebrospinal meningitis	790	198	Poliomyelitis	8	1
Diphtheria and croup	433	52	Scarlet fever	194	6
Dysentery	14	1	Sepsis	5	2
Encephalitis	2	2	Tetanus	27	15
Erysipelas	171	6	Typhoid fever	132	14
Favus	4		Typhus fever	58	2

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of May 31, 1940, pages 1000–1002. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Belgian Congo—Tchemba.—During the week ended May 4, 1940, 4 fatal cases of plague were reported in Tchemba, Belgian Congo.

United States—Washington.—A report of plague infection in Lincoln County and Spokane County, Washington, appears on page 1094 of this issue of PUBLIC HEALTH REPORTS.

Public Health Reports

VOLUME 55 JUNE 21, 1940 NUMBER 25

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work. Articles of special interest are issued as reprints or as supplements, in which forms they are made available for more economical and general distribution.

Requests for and communications regarding the PUBLIC HEALTH REPORTS, reprints, or supplements should be addressed to the Surgeon General, United States Public Health Service, Washington, D. C. Subscribers should remit direct to the Superintendent of Documents, Washington, D. C.

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Public Health Reports

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DEDICATION OF THE NEW BOSTON MARINE HOSPITAL

The dedication of the new marine hospital at Boston, Mass., on June 6, 1940, was a significant milestone in the history of the Public Health Service. It was significant for many reasons. The medical and hospital care of American merchant seamen was the first (and long the only) function of the Service; the first treatment furnished seamen under the authority of the act of 1798 was given in Boston in 1799; the first permanent marine hospital built by the Federal Government was that erected in Boston (Charlestown); and, of especial interest today, the marine hospital service may well be considered the first compulsory hospital insurance plan adopted in America. It is of interest to note that the Boston Marine Hospital is also the oldest hospital in Massachusetts, and believed to be the fourth oldest in the United States.

The first marine hospital erected in Boston was built in 1803, on 5 acres of land in Charlestown, and was occupied early in 1804. This hospital cared for the sick and wounded officers and members of the crew of the frigate *Constitution* and prisoners from the *Guerrière* after their engagement in what now may modestly be termed the slight unpleasantness of 1812. Before this hospital building was made available, medical and hospital care was provided seamen in a temporary building, the barracks at Fort Independence, Castle Island.

With the increase in shipping activities at Massachusetts ports, and the resultant increase in the number of seamen employed, increased bed capacity and improved facilities became necessary from time to time, which were provided by successively larger buildings occupied in 1827 and 1860. The present new building was occupied on June 1, 1940.

The principal address at the dedication ceremony was made by Federal Security Administrator Paul V. McNutt, whose remarks are printed in full elsewhere in this issue. Mr. McNutt pointed out that

the act of 1798, providing medical and hospital care for sick and disabled merchant seamen, a group in especial need of such services, was one of the first acts of our young Federal Government which recognized its responsibility for the welfare of the people; and that in this work the present Federal security program actually had its roots in the very beginning of our Government. He referred to the hospital building as the visible embodiment of democracy, and stated that it represents the solicitude of the Government for the sick and is a tangible "reassurance that the individual citizen is still the first concern of the Nation."

Surgeon General Parran reviewed the history and progress of the marine hospitals, summarized his expectations regarding new hospitals, and spoke of the new program for providing hospitals in needy rural areas, the bill for which is now before Congress.

Assistant Surgeon General S. L. Christian, Chief of the Division of Marine Hospitals and Relief, commended the work of the staff, attendants, and others concerned with the task of preparation for the opening of and the transfer to the new building, expressed appreciation of Congressional action in making funds available for the much needed new facilities, and thanked the architects and construction experts who designed and built the hospital.

The principal speaker at the luncheon held in connection with the dedicatory exercises was Dr. Roger I. Lee, professor of public health at Harvard University and a member of the National Advisory Health Council. In speaking of the need for continued progress, Doctor Lee said that a hospital is never actually completed, either physically or spirtually, even though "you have moved in." Not only must the physical walls and equipment be changed, but the mental walls must be changed as well. "The succession of five marine hospitals at Boston,[1] " he said, "was evidence that the marine hospital system of the Public Health Service has been keeping abreast of progress."

A personal connection with the past was provided at the dedication in the presence of Col. David Townsend, the great-grandson of the third commanding officer of the first marine hospital constructed at Boston, Dr. David Townsend. Dr. Townsend succeeded Dr. Benjamin Waterhouse in 1809 and served as medical officer in charge until his death in 1829.

The new hospital is located on a site of approximately 13 acres on Warren Street (No. 77), near Commonwealth Avenue. It is of modified Georgian style of architecture, of red brick and brown limestone construction, and has a bed capacity of 360. On the site are also ample quarters for medical officers, nurses, and attendants,

[1] Counting the barracks at Castle Island which were used for the first or temporary hospital before the first permanent marine hospital was built Counting all buildings used in Boston for the marine hospital, the present building is the sixth, as a rented building in Charlestown was used from 1825 to 1827.

The four U. S. Marine hospitals built by the Federal Government at Boston. Above: Left, first hospital, 1804–25; right, second hospital, 1827–58. Center: Third hospital, 1858–1940. Below: New hospital, occupied on June 1, 1940.

RULES AND ORDERS

OF THE

United States Marine Hospital,

ESTABLISHED AT CHARLESTOWN

ARTICLE I

THE OVERSEER or STEWARD is to go through all the wards in the morning before the Physician visits them, to see that the men have washed their hands and faces, and that nothing offensive be left in the rooms, and he is to go again through the wards before bed time to see that all the patients be in the house, and that none remain in it that do not belong to it

ARTICLE II

Every patient is to retire to rest on or before nine o clock in the winter months, and by ten in the summer, and no lights are to be allowed or fire kept up after that period, unless some special case should require it

ARTICLE III

Every patient in the house is enjoined to pay strict obedience to the orders of the Steward or Overseer and should any patient think him elf at any time aggrieved he has the liberty of appealing to the Physician

ARTICLE IV

Every patient is to be shaved every Sunday and Wednesday, and shirted every Sunday, and oftener if convenient, and he is to wash his face and hands and comb his head every day, if his case and circumstances will admit of it

ARTICLE V

Every patient is forbidden to spit on the floor or hearth, or write on the walls, or mark the wood work or drive nails in either

ARTICLE VI

If any man pertinaciously disobeys the orders of the Physicians or overseers, or gets drunk, or commits riot or is found guilty of theft, he forfeits the privilege of the hospital and shall be dismissed

ARTICLE VII

No patient is allowed to go to Boston or to any distance from the hospital without permission from the Physician, or Overseer, or house pupil

ARTICLE VIII

If any patient be found to throw away his medicine, or feign complaints, or who wilfully does any thing to impede his cure, he shall, upon conviction thereof be dismissed

ARTICLE IX

No person is allowed to play cards or any other game of hazard for money drink or any other article

All games of amusement, accompanied with noise are forbidden as they disturb the sick

ARTICLE X

Whatever patient be out of the house all night without permission from the Physician or Overseer is from that time dismissed

ARTICLE XI

All the patients shall be in their own wards, and places when the Physician is ready to visit them, of which they will be notified by the ringing of the bell

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ARTICLE I

NURSES—Are to see that the patients be neat and clean as the nature of their cases will admit They are to see particularly as to the cleanliness of the bed and bedclothes They are to see that the wards be kept extremely clean and that they be aired by keeping the windows and doors open in fair weather a longer or shorter time as the weather may admit And they are to see that no nastiness of any kind be thrown out of the windows or doors

ARTICLE II

The nurses male or female are upon no pretence to alter the diet ordered by the Physician nor to suffer the patients to use any other diet than what is allowed by the hospital nor are they to permit spiritous liquors of any kind to be brought into the wards, except what is directed by the Physician They are to attend to the particular disgusts and cravings of the sick, and report them to the Physician

ARTICLE III

The effects of men, who die in the hospital are to be locked up and reported as soon as may be to the Physician and if any nurse, attendant, or any other person, should take away or conceal any article belonging to such as die in the hospital, their crime shall be reported to the *Superintendent*

ARTICLE IV

The hours for admission of patients are between 10 and 12 but should any that are lame or weak present themselves before or after that time, the house pupil, or the overseer or the head nurse may receive them, and give them such articles of food only as are allowed in the *low diet* until the Physician see them ——No person can be admitted into the hospital with the itch, or any other infectious disorder, the venereal excepted

ARTICLE V

No Seaman can be admitted into the hospital without a written certificate from the Custom House, that he has paid hospital money

APRIL 1808

Facsimile of the "Rules and Orders" of the Boston Marine Hospital drafted by Dr Benjamin Waterhouse in 1808

laundry, storage facilities, powerhouse, garage, and machine shop. The hospital building has an auditorium with a seating capacity of 300, modern in acoustic construction, and has a stage and dressing room facilities. The auditorium will be available for medical meetings, including those of the local medical society, and for the recreation and entertainment of ambulant patients.

The equipment is the best and most modern available, not elaborate or ostentatious, but of suitable quality for the best care of both bed and ambulant patients.

The staff and personnel of the old hospital were transferred in a body, and will be augmented as required in the future.

AN ADDRESS BY THE HONORABLE PAUL V. McNUTT, FEDERAL SECURITY ADMINISTRATOR, AT THE DEDICATION OF THE U. S. MARINE HOSPITAL, BOSTON, MASS., JUNE 6, 1940

It is reassuring to be in Boston again. In these troubled times Boston, the cradle of American liberty, gains an added significance and a heightened place in our affections.

Every American city has its special appeal. Each one has the characteristics of its region and the peculiar qualities of the people who made it and now live in it. But all over our country, in every city and hamlet in the land, Boston holds a place of its own, unique and unchallenged. It means something to all of us because something of our roots are buried here. It is good to remember that the "tea party" did take place; that Paul Revere took his famous ride; that embattled farmers fought at Lexington.

When I walked across the Common this morning, I felt a certain security of spirit that comes from the knowledge of a great fighting tradition, of a great culture, of achievement in all the arts, in science, in medicine—a sense of communion with great men of the past and a realization of its great citizens of today in every walk of life.

Boston is American in the true sense. It is the melting pot quite as much as other cities in the East, and in the Far West and the Middle West. It has demonstrated the truth of what men are fighting for in Europe: That people of many origins can live together in peace, trusting each other in the fundamentals.

Yes, it is good to be back. And I am happy that the occasion which brings me is the dedication of this Public Health Service marine hospital, the first to be established in the Federal Government's first program for human welfare and the last of the 26 marine hospitals to be rebuilt on modern lines.

When the President created the Federal Security Agency last July, pursuant to the Reorganization Act, he sought, in the modern trend of government administration, to group together agencies having related functions. Why the Public Health Service had been in the Treasury was a question hard to answer since the reason had long been forgotten.

When the Service was first established, it was an agency to furnish medical service and hospital care to sick and injured seamen from American vessels. The collectors of customs were the business agents of the hospitals. They handled the money and paid the bills. As the collectors of customs came under the Treasury Department, so did the marine hospitals. But over a half century ago the collectors of customs ceased to be the business agents of the hospitals. Since that time, Congress has expanded the hospital service to include many duties much more closely related to the work of the Federal Security Agency than to that of the Treasury Department.

The history of the Public Health Service makes us realize that the great Federal security program, administered by the Federal Security Agency, had roots in the beginnings of our Government. The main function of the Public Health Service for so many years, namely, the medical care of sick and injured seamen, was one of the first acts of our young Federal Government in recognition of its responsibility for the welfare of our people.

This program has been extended both in concept and function until today the citizens of our democracy have charged their Government with responsibility for many functions in the service of mankind of which the founding fathers never dreamed in our frontier years. The Public Health Service has evolved from a hospital service for one small group into our first-line defense for the promotion and preservation of the health of all the people.

Each of the other units of the Federal Security Agency also touches millions of Americans. The Social Security Board reaches with its two big insurance features, unemployment compensation and old-age insurance, 50 millions of people, and its public-assistance programs serve many additional millions among the needy aged, dependent children, and the blind.

The National Youth Administration and the Civilian Conservation Corps have as their primary responsibility the conservation of the health and morale of our young people, with emphasis upon training them for self-supporting, intelligent citizenship. The Office of Education is our third instrument to help American youth. Through its advisory services to the schools and its vocational education and rehabilitation program it reaches almost every community in the Union.

The present grouping of these agencies under one administrative unit, the Federal Security Agency, is a visible sign of our realization that all the services designed to "promote the general welfare" are interdependent, one upon the other, and that only with close cooperation can these services be integrated into an effective program. The problems of human welfare which our democracy seeks to solve through these services have common causes, common means of solution, and a common objective, namely, to prove that a democracy can and will function for the protection and the promotion of its human resources.

The oldest member of the Federal Security Agency family is the Public Health Service. The story of its origin, its growth, and achievement is well known to this audience. To me it is of much interest and significance, for if one desires to serve in furthering the objectives of an undertaking, one must know its past and the reason for its beginning.

The active life of the Service began in the first Boston Marine Hospital. That story has been admirably told for all of us here today by Doctor Trask in the little booklet which commemorates this occasion. To him we pay tribute not only for his achievements as physician and hospital administrator, but also for his interest and ability as an historian. His chronicle of the past meets the true test of history. It creates a desire to visit the Boston Marine Society and talk with the ships' captains who are today carrying on the work of an organization nearly two centuries old, to visit Fort Independence, site of the first Boston Marine Hospital, and the grave in King's Chapel churchyard of Doctor Welsh, and many other points of interest which illuminate the past.

These things enrich our understanding of the tradition of service which even today inspires the work of the Public Health Service. As we survey the years of life of the Service, we are forcibly impressed with its role as the searcher, the demonstrator, and the leader in the forward advance of public health. Its work has been and will continue to be the search for new and better ways of dealing with problems affecting the people's health, a demonstration of their most effective use and an example of that use.

That role has been maintained continuously since the very day when this old marine hospital first opened its doors. It was the first hospital in Boston, the fourth in the Nation. Thomas Welsh, first physician in charge, had little to guide him in his task of organizing and creating a general hospital. Within a few years, with the aid of Benjamin Waterhouse, also an outstanding figure in the history of American medicine, this institution became a demonstration of what constitutes a good hospital and good hospital practice. In its early days, too, the hospital took its place in the evolution of American medical education.

It became the "teaching hospital" of the Harvard Medical School and remained so for a number of years.

From those beginnings there has descended in the Public Health Service a long line of important "demonstrations" in the wider fields of scientific research, quarantine procedure, epidemiology, and public health control and administration. It is the desire of all of us that in this role of demonstration and leadership the Public Health Service may continue to make significant contributions, not only in research and public health practice, but in medical practice as well. And our hopes for this new hospital in Boston beget the thought that here, in the years ahead, we may so effectively put to work the newer knowledge in medicine as to present within these walls an inspiring example of modern science at its peak of swift and efficient relief of human suffering.

This hope goes beyond the desire to ease immediate pain. We like to think that the day will come when this hospital is not simply a place to which its beneficiaries resort in emergencies, but a port of call for the prevention of future illness, a harbor from which the patient goes refreshed both in body and in spirit, better able to meet his world and the people and conditions which form it.

This hope is strengthened by consideration of some of the miracles of modern medical science. For example, in the recent use of chemotherapy for infectious diseases, we are witnessing one of the most remarkable developments in the history of medicine. We remember also that man suffers not from infectious disease alone. He is an organism both ruled and tyrannized by his emotions. The emotional factors in disease are also being recognized and studied as of great importance, especially in the treatment of the more chronic and debilitating conditions.

Man is not to be considered a physical body with a separate mind, but rather as a complete and indivisible being. When he is ill, the whole organism is ill. Consideration of the patient's feelings, anxieties, and fears, of the causes of these emotions, and their alleviation in the treatment of his illness are also among the important advances in medicine. So we find that, in the modern hospital, increasing emphasis is being placed upon the personal relationships between the patient and those who care for him, upon the kindliness of his reception when the patient enters its doors, upon allaying unnecessary fear and apprehension, and upon obtaining from him the invaluable cooperation in recovery that comes from his confidence in physician and nurse and in their sympathetic and intelligent understanding of his individual case.

We could find no better place for the fulfillment of this future aim than Boston, one of the great medical centers of our country. In this setting are some of the oldest and most renowned medical schools in

America, leaders in medical research and medical education, distinguished practitioners in medicine and public health—men to whom we owe much of the progress made in the treatment of the sick, in our knowledge of the causes of disease, and in public health administration, men who have been leaders in everything connected with American medicine.

The relationship which exists between the marine hospitals of the Public Health Service and the medical profession of the communities in which they are established is, and always has been, intimate and cordial. Through the continued maintenance of consultant staffs, the hospitals have profited immeasurably by direct contact with practicing physicians and clinicians.

It is our hope that this new Boston Marine Hospital will take its place and make its contribution in the medical world of Boston. Their interests are identical; their objectives the same. Their programs should be mutually helpful and complementary.

As we meet here today near the old Boston harbor where once the *Constitution*, and the *Congress*, and the *President*—frigates of our young Navy—discharged their wounded to the marine hospital at Charlestown, I feel very strongly the importance of such a relationship. In the difficult days ahead for this Nation, as we rise to gird democracy for its defense, let us not for a moment forget that we must have both military defense and a prepared people, physically and spiritually able to perform their tasks.

Without the leadership and guidance of our medical institutions and our men of medicine, without the cooperation between Government and medicine, such as that demonstrated in the Public Health Service hospitals, we cannot raise this bulwark of human defense. We cannot be totally prepared.

In a very real sense, this hospital is the visible embodiment of democracy. It represents the solicitude of the Government for the sick. It is tangible reassurance that the individual citizen is still the first concern of the Nation. It somehow reminds us that whatever happens elsewhere in the world, America is one land where the ideals of humanity and Christian love still prevail as the dominant influence in our national life.

OCCUPATIONAL LEUKODERMA

By Louis Schwartz, *Medical Director, United States Public Health Service*, Edward A. Oliver, M. D., *Chicago*, and Leon H. Warren, *Acting Assistant Surgeon, United States Public Health Service*

About September 1938, the Negro workers of a large tannery began to complain to the management that white spots (fig. 1) were appearing on the areas of skin of their forearms and hands which were covered by the rubber gloves furnished for their use by the factory.

The men working in the beam house and tan house and the color and fat liquor departments were said to be the only ones affected. There was itching, and in some cases a mild dermatitis preceding the appearance of the depigmentation, but there was no great discomfort or any disability. However, the psychological reaction on some of the men was bad, and by the early part of 1939 several of the workers had instituted law suits for damages.

All of the affected workmen were said to have been wearing a heavy gauntlet type of rubber glove having curved fingers, known as a heavy acid rubber glove. Up to April 1937 they had been wearing the same type of glove but with straight fingers. After that time the management furnished them with the curved-fingered gloves.

The condition continued to progress so that in some instances most of the skin covered by the gloves became depigmented (fig. 2), while in other instances the skin covered by the gauntlet was only spotted with areas of leukoderma (fig. 3). A few of the workers also developed leukoderma on parts of the body not covered by the gauntlets, but these parts were all on areas of the body which could have been touched by the gloves (fig. 4). The hairs in the leukodermic areas were not affected. As a result of these complaints, the management discontinued the use of the curved-fingered glove early in May 1939 and consulted the Department of Leather Research of the University of Cincinnati concerning this matter.

The Leather Research Department referred the matter to the Surgeon General of the United States Public Health Service on May 16, 1939. About the same time the representatives of the rubber company who manufactured the gloves came in person to consult the Office of Dermatoses Investigations in regard to the same matter. The Office of Dermatoses Investigations then began the investigation by first trying to ascertain by correspondence whether similar cases had occurred in other tanneries.

In June 1939, one of us (E. A. O.) was called in by the insurance company which carried the insurance of the tannery to see 18 cases of a peculiar depigmentation occurring among a group of Negroes and Mexicans working in the tannery.

A few days later a letter was received by the Office of Dermatoses Investigations from another tannery stating that some of their colored and white workers had depigmentation of the skin of the hands and forearms involving the areas covered by their rubber gauntlets, and asking whether this office had any reports of a similar condition. Since these first two reports, we have received letters reporting the occurrence of similar cases in other industries located in various parts of the United States where rubber gloves of the same manufacture were worn.

FIGURE 1 —Patchy depigmentation

FIGURE 2 —Uniform depigmentation

FIGURE 5.—Patchy depigmentation

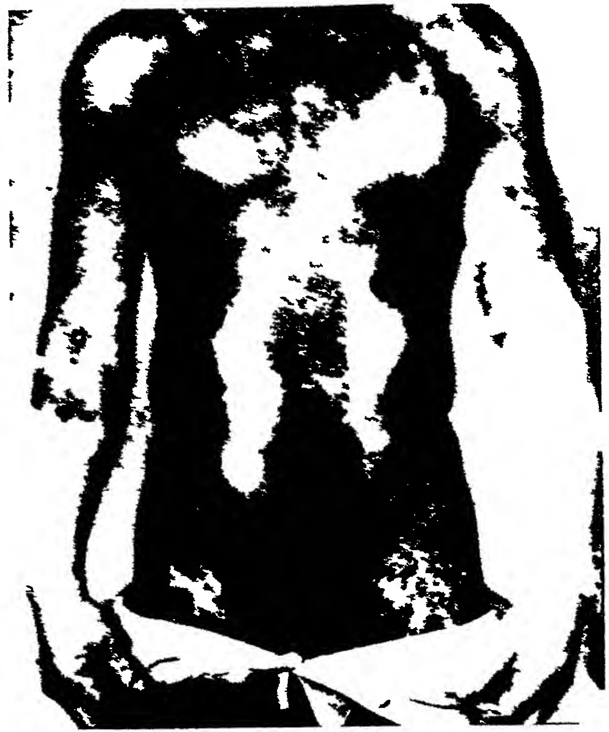


FIGURE 4.—Widespread involvement resembling vitiligo

The cities in which the two tanneries are located were visited and an active investigation was begun.

In the first tannery all the workers were examined, and it was found that out of about 500 employees only 48 wore the suspected rubber gloves. These 48 were all employed in 4 departments of the tannery. The total number of workers in these 4 departments was 88. Of the 48 who wore the gloves, 25, or 52 percent, had developed leukoderma. Of the 11 workers in the tan house, 10 wore rubber gloves and 6 of these developed leukoderma, an incidence of 60 percent. Of the 4 workers in the hand finishing department, 2 wore rubber gloves and both of these developed leukoderma. Of the 16 workers in the color and fat liquor department, 13 wore the gloves and 7 of these developed leukoderma, an incidence of 54 percent. Of the 57 workers in the beam house, 22 wore gloves and 9 developed leukoderma, an incidence of 41 percent. The janitor who wore the rubber gloves while cleaning also developed leukoderma. Sixty percent of the workers affected were Negroes, 20 percent were Mexicans, and 20 percent were white. On the basis of complexion, 31 percent of the Mexicans wearing the gloves, 29 percent of the Negroes wearing the gloves, and 21 percent of the white Americans wearing the gloves developed leukoderma.

The areas of leukoderma showed a flat white in contrast with the dark skin of the Negroes; the contrast was not so marked against the lighter skin of the Mexicans; and in the case of the white Americans the leukoderma was noticed only in the summer when the skin covered by the gloves failed to tan.

At the time of our examination there were no signs of any acute or chronic dermatitis present on any of the leukodermic areas. In some instances the hairs were lost over the leukodermic areas, in others the hairs were short and stubby as if they had been depilated and grown back, and in other cases the hairs were unaffected. In no case, however, were the hairs depigmented. The loss of hair may not necessarily have been due to anything in the glove, since many of the chemicals used in tanning leather are depilatories and loss of hair on the arms of workers with these chemicals is not uncommon.

In studying the process of tanning used in this factory, we learned that dimethylamine was used as an unhairing agent. Since we had not previously seen this chemical used as an unhairing agent in tanneries, we at first suspected that the leukoderma might have been directly or indirectly caused by its action on the skin. This, however, we disproved later in our investigation.

The company officials in the second tannery stated that their workers had never used the curved-fingered gauntlets but only the straight-fingered ones; yet some of their workers in the beam house, the tan yard, and the fat liquor departments were affected with leuko-

derma on areas of skin touched by the straight-fingered gloves. The officials also stated that there was no dimethylamine used in their tannery, the unhairing being done with the usual mixture of lime and sodium sulfide. In this tannery 16 workers with leukoderma on parts touched by the rubber gloves were seen. Five of them were white workers who stated that they noticed the leukoderma only when the warm weather began and the areas touched by the gloves failed to tan. The first cases of depigmentation were called to the attention of the management in December 1938. This tannery purchased its gloves from the same rubber company as the first tannery.

Since the workers in this tannery did not at any time use the curved-fingered glove, and since they did not use dimethylamine and yet were affected by leukoderma, it now became apparent that dimethylamine was not the cause of the leukoderma, and that the curved-fingered gloves were not the only ones that caused it.

In order to see whether workers in other tanneries in which rubber gloves manufactured by this company were used had the same condition, we visited a third tannery, the name of which was given to us by the jobbers who sold the gloves. In this tannery it was found that both the curved- and straight-fingered gloves were used, that dimethylamine was not used, and that workers who wore either kind of gloves made by this company for any length of time had leukoderma.

Never before in the history of any of these tanneries had such a condition occurred on the skin of the workers. In the knowledge of the authors no similar outbreak has been reported in the literature before our preliminary report in the Journal of the American Medical Association on September 2, 1939.

In order to ascertain whether the leukoderma due to wearing these gloves occurred only in tanneries or whether it occurred in other industries where the rubber gloves were worn, the names of various manufacturing companies where these gloves were used were obtained from the jobbers, and these factories were visited. They included decalcomania manufacturers, electrical apparatus manufacturers, meat packing plants, and electroplating works. In all of them some of the workers who wore this particular brand of gloves were found to have leukoderma on areas covered by the rubber gloves. As in the tanneries, the white workers noticed the condition only with the coming of summer when the skin touched by the rubber gloves failed to tan.

Samples of the gloves causing the leukoderma were obtained and taken to the factory of the rubber company which manufactured them. They identified the gloves as being what they called their "acid-cured" gloves. The officials of this company stated that they had been making these gloves for many years, but that in September 1937 they had made a change in the formula, consisting in the addi-

tion of 0.2 percent of an antioxidant,[1] which they said was monobenzyl ether of hydroquinone, containing less than 1 percent of unchanged hydroquinone as an impurity. Based on the amount of smoke sheet rubber in the rubber compound from which the gloves were made, the amount of the antioxidant added to the formula was 0.5 percent. The formula of the rubber glove which caused the leukoderma was as follows:

Smoke sheet rubber	100 parts.
Chrome yellow	5 parts.
Whiting	125 parts.
Cumar	3 parts.
Stearex beads	10 parts.
Antioxidant (monobenzyl ether of hydroquinone)	0.5 parts.[2]
A small amount of soapstone.	

The process of manufacturing the glove is as follows: The ingredients are mixed in a mix mill and rolled into thin sheets. The sheets are cut up into small pieces and placed in metal drums containing petroleum naphtha. There are 7 parts of naphtha to 1 part of compounded rubber. The drums are revolved for about 48 hours, after which time the rubber is completely dissolved. The solution is then pumped into a storage tank from which it is allowed to run into the dipping vats as required. Porcelain forms are dipped into the solution in the vats and allowed to remain for a short time. The rubber deposited on the forms is then allowed to dry. The forms are repeatedly redipped until the desired thickness of rubber is obtained. They are allowed to dry and are then cured or vulcanized by immersing for about 1 minute in a 4 percent solution of sulfur monochloride in benzol. They are again allowed to dry, taken off the forms, turned inside out, again put on the forms and redipped in the sulfur monochloride in benzol, so that both sides of the glove may be cured. They are then allowed to dry, taken off the forms, and dusted with soapstone.

The heavy acid gauntlets have a chocolate-colored layer incorporated between the inner and outer layers. The chocolate-colored layer contains brown oxide of iron instead of chrome yellow. This is done because originally the users of the gloves were accustomed to wearing a glove having such a chocolate-colored middle layer. All the different styles and weights of acid-cured gloves made by this rubber company were made from rubber compound stored in one tank and had the same composition.

All the rubber compound for making acid-cured gloves mixed during the period from September 1937 to October 1938 contained the anti-

[1] Antioxidants are used in rubber to retard the ageing or oxidation of the rubber, in the course of which the action of heat, light, and oxidation causes the rubber to lose its elasticity, to crack, and to discolor.

[2] This equals 0.2 percent of antioxidant based on the weight of the glove.

oxidant monobenzyl ether of hydroquinone. However, as the large storage tank containing the solution of the rubber compound in naphtha, to which the new formula was added, was not emptied before storage of the new stock began, a considerable time elapsed before the rubber compound in the storage tank contained the full strength of 0.2 percent of monobenzyl ether of hydroquinone, and it was not until some time after October 1938 that the antioxidant had entirely disappeared from the rubber compound in the tanks.

Since it takes a considerable time after the gloves are manufactured for them to be in the hands of the users, it was probably not until October or November 1937 that any gloves containing the antioxidant were actually being worn.

In October 1938 the company received a complaint from a factory manufacturing gaskets and brake-lining materials, stating that 10 of 15 girls wearing the acid-cured gloves were affected with dermatitis. As a result of this the antioxidant was withdrawn from the formula. Because the new rubber compound was not emptied from the tanks, gloves containing some of the antioxidant were probably still being made as late as the early months of 1939 and were being sold to workers at an even later date. Sample gloves obtained from the jobber late in May 1939 failed to cause leukoderma or patch-test reactions on the involved workers. These same workers, however, showed patch-test reactions to rubber gloves manufactured in 1938.

Samples of all the ingredients going into the manufacture of the gloves were obtained from the rubber company. Workers having leukoderma were patch tested with these chemicals. The tannery first reporting the cases was selected as the place for doing the major portion of the patch tests because it had the largest number of cases and because the management and the workers showed a willingness to cooperate.

Ten workers who had leukoderma were patch tested with the following substances which went into the manufacture of the rubber gloves:

1. Chrome yellow.
2. Stearex.
3. Antioxidant.
4. Whiting.
5. Soapstone.
6. Cumar.
7. The same antioxidant.
8. Pieces of a new acid-cured rubber glove made by the rubber company.[3]

The patches were allowed to remain on for 7 days.

[3] It was later found that this rubber glove was manufactured about April 1939 and therefore could not have contained more than a trace of the antioxidant.

TABLE 1.—*Results of patch tests allowed to remain on the patients' backs*[1] *from July 10 to July 17*

	Patch No. 1, chrome yellow		Patch No. 2, stearex		Patch No. 3, antioxidant		Patch No. 4, whiting		Patch No. 5, soapstone		Patch No. 6, cumar		Patch No. 7, antioxidant		Patch No 8, rubber	
	July 24	Jan 25	July 24	Jan. 25	July 24	Jan. 25	July 24	Jan. 25	July 24	Jan. 25	July 24	Jan. 25	July 24	Jan. 25	July 24	Jan. 25
O.	-----	-----	-----	-----	+	-----	-----	-----	-----	-----	-----	-----	+	-----	-----	-----
J. T.	-----	-----	-----	-----	(+) +	(++)	-----	-----	-----	-----	-----	-----	++	(++)	-----	-----
H. E.	-----	-----	-----	-----	+	(+)	-----	-----	-----	-----	-----	-----	+	(+)	-----	-----
L. E.	-----	-----	-----	-----	+ (+)	(+)	-----	-----	-----	-----	-----	-----	+ (+)	(+)	-----	-----
S. V.	-----	-----	-----	-----	++	(−)	-----	-----	-----	-----	++	(−)	+	(−)	-----	-----
M. H.	-----	-----	-----	-----	+ (+)	-----	-----	-----	-----	-----	-----	-----	+ (+)	-----	-----	-----
J. J.	-----	-----	-----	-----	++++	(++)	-----	-----	-----	-----	-----	-----	++++ (+)	(++)	-----	-----
D. K.	-----	-----	-----	-----	+	(−)	-----	-----	-----	-----	-----	-----	+++	(−)	-----	-----
L. P.	-----	-----	-----	-----	++ (+)	(+)	-----	-----	-----	-----	-----	-----	[2] − (+)	(−)	-----	-----
M. S.	-----	-----	-----	-----	++	(+)	-----	-----	-----	-----	-----	-----	+	(+)	+	(−)

[1] All blank spaces in this table represent tests in which there were no skin reactions and no leukoderma.
[2] Lost patch.
+ and − = skin reactions.
(+) = leukoderma.
(++) = spread of leukoderma.
(−) = no leukoderma.

It will be noted from table 1 that all of these workers reacted to patch No. 3, the antioxidant, and to patch No. 7, also the antioxidant, except one (L. P.) who lost the chemical from under patch No. 7. There was only one reaction to patch No. 8, rubber glove containing only traces of the antioxidant, and one reaction to patch No. 6, cumar. There were no reactions under any of the other patches. It is possible that the reaction to patch No. 6 was due to the fact that this worker was sensitive to cumar, but since leukoderma later developed at this site it is more likely that the patch was accidentally contaminated with the antioxidant from patch No. 7 at the time of its application. On July 24, 1939, or 2 weeks after the patches were applied, there were signs of leukoderma on the antioxidant patch test sites of 5 of the workers (fig. 5). On the next inspection, made on January 25, 1940, 8 of the 10 workers were seen and 3 of them who had shown no leukoderma on July 24 now showed leukoderma at the site of the patch test with the antioxidant (fig. 6). Areas of leukoderma produced by the patch test that were noted on 2 workers at the time of the first inspection had by this time become repigmented. There seemed to be no definite correlation between the intensity of the skin reaction to the antioxidant patch tests and the subsequent development of leukoderma. The leukoderma began to develop about 1 week after the removal of the patches in the majority of the cases. It reached its peak some time between July 24, 1939, and January 25, 1940, so that by January 25, 1940, 2 of the leukodermic patch test sites had become entirely repigmented and the others showed areas of repigmentation.

Repigmentation of the skin on the arms first occurred on small sites around the hair follicles scattered over the leukodermic area (fig. 7). The skin first appeared a light brown color, the color later increasing in intensity. The areas of repigmentation spread and coalesced (fig. 8).

According to the manufacturers the antioxidant is monobenzyl ether of hydroquinone, containing a fraction of 1 percent of unchanged hydroquinone as an impurity. It is a light tan-colored powder with an aromatic odor, melting at 115° to 120° C., and having a specific gravity of 1.26. It is very slightly soluble in water, practically insoluble in petroleum hydrocarbons, but soluble in benzol and in rubber up to 2 percent. It is said to be nontoxic in ordinary handling and not to "bloom" when used up to 1 percent on the rubber. It is nondiscoloring in diffuse daylight and gives a minimum discoloration in direct sunlight. For this reason it is recommended by the manufacturers for use in white and light-colored rubber goods.

The workers continued at their occupations while wearing the patches and we thought that perhaps some of the chemicals with which they worked may have had an influence on the patch tests. In order to determine further whether the tanning liquors containing these chemicals had some effect on the ingredients in the rubber and formed new compounds which may have caused the leukoderma, pieces of the rubber glove used for patch test No. 8 were dipped into the various tanning liquors and applied as a patch test on 6 other workers affected with leukoderma.

Patch No. 1 consisted of the rubber dipped in a 1 percent solution of dimethylamine. (These patch tests were done in the tannery in which the dimethylamine was used in conjunction with lime as an unhairing agent.)

Patch No. 2 consisted of the rubber dipped in the actual unhairing solution consisting of a mixture of dimethylamine and lime. Since this unhairing solution is strongly alkaline and therefore caustic and would cause dermatitis on the normal skin if applied as a patch test, the alkalinity was reduced to pH 11 by the addition of a few drops of sulfuric acid. (It has been found that the normal skin will withstand for 24 hours a patch test with a solution having a pH 11.)

Patch No. 3 consisted of a piece of the rubber dipped into the tanning solution. The tanning solution is a green liquid consisting of about 1.5 percent of chromium sulfate and sufficient sulfuric acid to give it a pH of 3.3.

Patch No. 4 consisted of a piece of the rubber dipped in the liquid expressed from the leather taken out of the fat liquor drums. This liquor consists of remnants of the various dyes and oils used in the fat liquoring process, and is approximately neutral in reaction.

These patches were taken off each day and inspected, remoistened with the liquors, and then reapplied for a total period of 7 days.

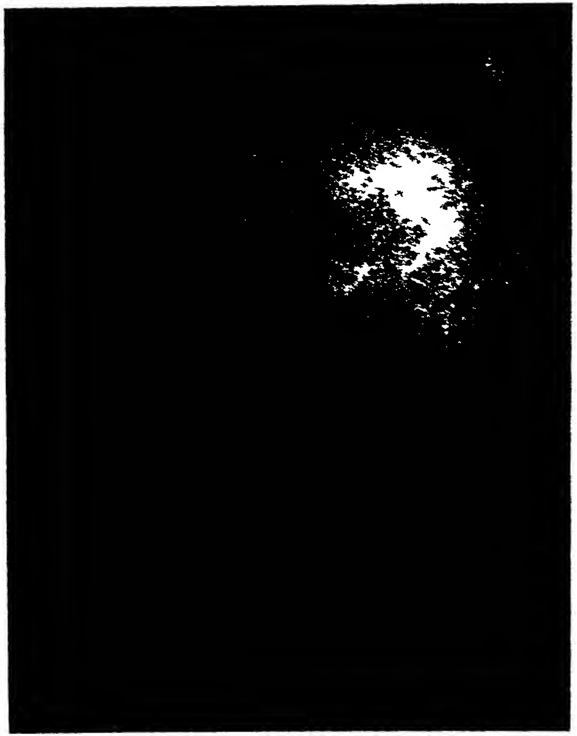


FIGURE 5.—Leukoderma at sites of patch tests with antioxidant powder

FIGURE 6.—Leukoderma at sites of patch tests with antioxidant

FIGURE 7 —Perifollicular repigmentation

FIGURE 8 —Coalescent repigmentation

TABLE 2.—*Results of patch tests allowed to remain on the patients' backs from July 11 to 17*

	Patch No 1	Patch No 2	Patch No 3	Patch No 4
	July 21	July 24	July 24	July 24
O M	–	–	–	–
J P	–	–	–	–
P B	–	–	–	–
C Mc	–	–	–	–
J T	–	–	–	–
T D [1]	+	+	+	+

[1] Delayed reactions appearing one week after patches were removed

It will be noted that there was no reaction under any of these patches at the end of the week. However, when the patch test sites were again seen 7 days after removal, one of the workers had a mild reaction under each of the 4 patches. This worker was the janitor and was not occupationally exposed to any of the tanning solutions, although he did have leukoderma caused by wearing the gloves while he was engaged in washing and scrubbing. This worker was either sensitive to something in the rubber or to all of the 4 tanning liquors. No leukoderma developed at the site of these reactions, because, as stated before, this rubber glove contained only a trace of the antioxidant. This experiment shows that the tanning liquors did not act on the other chemicals in the rubber gloves in such a way as to change their chemical composition and cause leukoderma.

In order to determine whether acid curing affected the action of the antioxidant in causing leukoderma, the rubber company manufacturing the gloves compounded a set of samples of the rubber glove in the various stages of manufacture.

Sample No 1 consisted of the antioxidant, 1 part, and smoke sheet rubber, 100 parts, milled together and rolled into a sheet.

Sample No. 2 consisted of the antioxidant, 0 5 parts, smoke sheet rubber, 100 parts, and cumar, 3 parts, milled together and rolled into a sheet

Sample No. 3 consisted of sample No 2, plus chrome yellow, 5 parts, milled and rolled into a sheet.

Sample No. 4 consisted of sample No. 3, plus whiting, 125 parts, milled and rolled into a sheet.

Sample No. 5 consisted of sample No. 4, plus stearex, 10 parts, milled and rolled into a sheet.

Sample No. 6 consisted of sample No. 5, with the exception that chrome yellow was omitted and for it was substituted 1.25 parts of powdered oxide of iron, milled and rolled into a sheet.

Sample No. 7 consisted of sample No 1 dissolved in petroleum naphtha in the proportion of 1 part of rubber to 7 parts of naphtha, deposited on a form and acid cured as described in the process of acid cured glove manufacture.

Sample No. 8 consisted of sample No. 2 treated in the same way as sample No. 7.

Sample No. 9 consisted of sample No. 3 treated in the same way as sample No. 7.

Sample No. 10 consisted of sample No. 4 treated in the same way as sample No 7.

Sample No. 11 consisted of sample No. 5 treated in the same way as sample No. 7.

Sample No. 12 consisted of sample No. 6 treated in the same way as sample No. 7.

We at first planned to patch test all the workers who had leukoderma with these 12 samples of vulcanized and unvulcanized rubber, but by the time that these samples were finished and received it had already been established that the antioxidant was the sole cause of the leukoderma. Hence it only remained to find whether vulcanization hastened or retarded its action, and also to find whether the small amount of hydroquinone present as an impurity played any part in causing the leukoderma.

Heinz Oettel (Archive für Experimentelle Pathologie und Pharmakologie, 183:319 (1936)) performed experiments with hydroquinone in connection with its contemplated use as a food preservative. During the course of these experiments Oettel fed cats daily doses of hydroquinone and observed among other signs of chronic hydroquinone poisoning that there was a depigmentation of hair. Thus, as a result of the oral ingestion of hydroquinone, the fur of black cats was temporarily changed to gray.

An ointment consisting of 20 percent of monobenzyl ether of hydroquinone in benzoinated lard was applied daily to the backs of 4 workers at the first tannery. On 3 of the men this ointment was rubbed over an area of the skin on which in the previous experiment the antioxidant powder had been applied for 1 week and no leukoderma had developed. The fourth man had not previously been patch tested with the antioxidant.

The ointment containing the antioxidant, and the 20 percent solution of the antioxidant in ether were applied 5 days a week for a period of 6 weeks to the skin of the four Negroes. Depigmentation on these sites was first observed 39 days after the beginning of these applications and upon final observation 5 months afterward all of the men showed large areas of depigmentation on the back where the ointment and the solution were applied.

To another small area on the back of these men a 20 percent solution of the antioxidant in ether was applied freshly each day.

Twenty-five workers were patch tested with vulcanized rubber containing nothing but 1 percent of the antioxidant. At the end of 1 week the rubber patches were removed, and 22 of these 25 men were examined. Four of these showed positive reactions at the site of the rubber patches, and 1 of the 4 showed a desquamation of the skin, underneath which there was a definite leukoderma. One of the 3 who did not show leukoderma at the time the patches were removed

developed leukoderma at this patch test site 2 weeks afterward. At this time (2 weeks afterward) 2 others showed ill-defined leukodermic spots at the site of the patch and 2 showed a brown scaling at the patch test sites.

Upon final examination on January 25, 1940, 12 out of 19 of the 25 workers patch tested with the vulcanized rubber containing nothing but 1 percent of the antioxidant showed leukoderma at the site of this patch test (fig. 9).

In the second tannery 4 workers were patch tested with the unvulcanized rubber containing nothing but 1 percent of the antioxidant. An ointment of 20 percent of hydroquinone in benzoinated lard was rubbed into an area of the back. A saturated solution of hydroquinone in ether was applied to a similar area. The rubber was allowed to remain on for 72 hours, at the end of which period 2 of the workers showed an inflammatory reaction consisting of erythema and vesicles. No leukoderma was present at this time.

The ointment was applied daily for 4 days, as was the saturated solution of hydroquinone in ether. There were no reactions noted at the end of this period.

These workers were again examined 16 days later, at which time there was a reaction at the site of the unvulcanized rubber patch on another one of them.

They were next observed 5 months afterward, and at this time 2 of them showed areas of depigmentation 1 inch square at the site of the unvulcanized rubber containing the antioxidant patch.

These experiments show that the antioxidant, alone or contained in rubber, either unvulcanized or vulcanized, can cause skin reactions and leukoderma even when applied to the skin for only 72 hours, and that the hydroquinone when applied in strong concentration for 96 hours produced no leukoderma on the same subjects. It therefore seems that the small percentage of hydroquinone contained as an impurity in the antioxidant played no role in the production of leukoderma.

As stated before, only 52 percent of the workers in tannery No. 1 who wore the gloves developed leukoderma. In some of the other factories investigated only about 10 percent of the workers who wore the gloves developed leukoderma. These facts indicate that perhaps some of the workers wore the gloves for longer periods of time than others and thus received larger doses of the antioxidant, or that some of the workers were more susceptible to its action than were others.

In order to find out whether leukoderma could be produced on the normal skin if a sufficient amount of the antioxidant were applied for a sufficient length of time, one of us (E. A. O.) applied the antioxidant in the form of an ointment and in the form of a solution in ether to the

skin of a colored patient in the hospital. Applications were made daily to a circumscribed area of the skin for 2 weeks, at the end of which time leukoderma developed. The leukoderma increased in intensity, and 4 months afterward there was still a definite leukoderma present at the site of the applications (fig. 10).

At the same time, one of us (L. S.) applied a specially prepared piece of vulcanized rubber containing nothing but 5 percent of the antioxidant on a freckled area of his own skin over the right shoulder. The rubber patch was allowed to remain on for 7 weeks. During this period a reaction consisting of erythema and vesiculation was observed at the site of the patch, but despite this reaction the patch was allowed to remain on. When the patch was removed the skin site showed a dermatitis, but no leukoderma or disappearance of the freckles. Since the leukoderma on the white workers was evidenced only after exposure to sunlight, the patch test site was exposed to 2 erythema doses of a mercury vapor lamp, divided into 2 sittings 1 day apart. There was a marked reaction in the form of an erythema at the site of the patch test and a much milder reaction of the surrounding skin, but still no visible leukoderma. The reaction went on to slight scaling and the area of skin surrounding it became tanned, but the site of the patch was erythematous and untanned. The site was observed from day to day, until 28 days later definite leukodermic spots were noticed over the area of the patch test site, and some of the freckles had disappeared.

These experiments show that if the skin is exposed for a sufficient length of time to a strong concentration of monobenzyl ether of hydroquinone it will in the course of 3 or 4 months become definitely depigmented.

After the investigation began, and after gloves containing more than traces of the antioxidant were no longer sold, no new cases of leukoderma developed on any of the workers observed.

At the end of our experiments, which occupied a period of 7 months, it was noted that all of the workers affected showed definite signs of returning pigment over the leukodermic areas (figs. 11 and 12). This indicates that the pigment-forming mechanism of the skin was interfered with but not destroyed by the antioxidant.

Biopsies were performed and the sections studied both by regular staining methods and by the dopa technique. The following is the report of examination of these sections by Dr. Frederick D. Weidman, of the University of Pennsylvania:

Patient J. T., slide No. 2802, a section showing repigmentation stained with the dopa reagent.

There is very slight hyperkeratosis in one portion of the section. Acanthosis is negligible. Pigmentation is spotty in distribution, and extreme in degree along a certain short extent of the epidermis. There is a rather singular occurrence,

FIGURE 9 —Leukoderma at site of patch test with 1 percent antioxidant in vulcanized rubber.

FIGURE 10 —Leukoderma produced by local applications of antioxidant

FIGURE 11 —Before regeneration of pigment began

FIGURE 12 —Regeneration of pigment Same patient as in figure 11, but 5 months later

FIGURE 13 Section from junction of normal and depigmented skin (dopa stain)

FIGURE 14 Section from junction of normal and depigmented skin (hematoxylin and eosin stain)

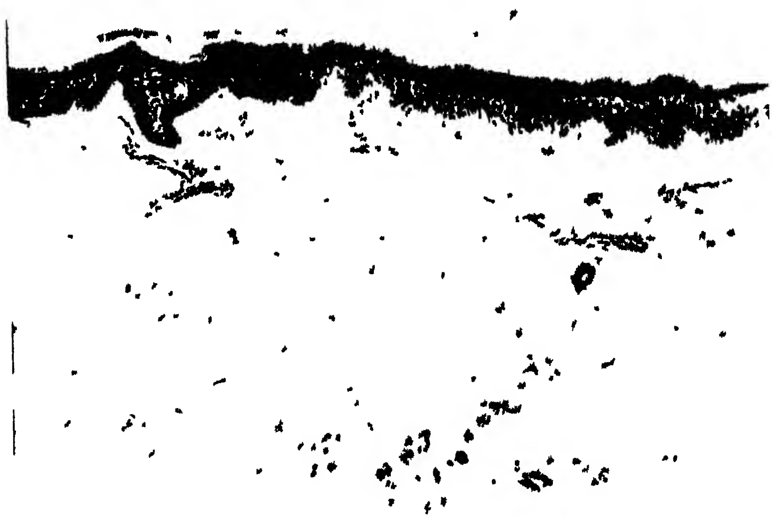


FIGURE 15 —Section from junction of normal and depigmented skin (dopa stain)

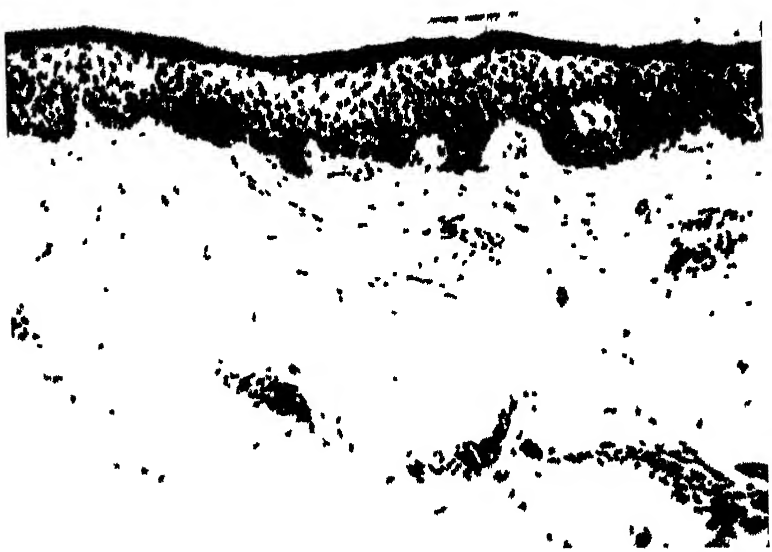


FIGURE 16 —Section exhibiting patchy depigmentation (dopa stain)

namely, that in the stratum corneum and the stratum granulosum the pigment has tended to accumulate in a way that does not appear consistent with the amount of pigment in the basal layers—a very distinctive appearance. In the deeply pigmented foci, pigmentation is greatest in the basal cell layer, with marked hyperpigmentation in the chromatophores in the tips of the dermal papillae. In the less pigmented areas there is also hyperpigmentation in these chromatophores. In general, there is no marked hyperpigmentation in the basal cell layer. The localization or distribution of the pigment is utterly irregular, but even where the pigmentation is not heavy there are fine pigment granules in the intercellular spaces. The dendritic cells are sharply outlined by powdery pigment grains in their stellate processes which extend far up into the epidermis. In all cases the pigment is extremely fine and powdery.

Interpretation of the pigmentation.—The primary activity is in the chromatophores which are present even around the sweat glands, but are most abundant in the tips of the papillae and the blood vessels of the subpapillary layer. The dendritic cells in the epidermis have engulfed this pigment, thus accounting for its transportation upward into the epidermis. A rather unusual phenomenon is this accumulation of pigment in the stratum granulosum and to a somewhat lesser extent in the stratum corneum. The basal cells themselves are not the site of this pigment production. In those places where the basal layer is pigmented it is due more to intercellular location of the pigment. However, there are still small quantities of pigment in the cytoplasm. The corium has a diffuse tingeing of the collagen bundles in addition to the pigment granules. In the sweat glands the cytoplasm of the secretory cells in particular, and to a less extent of the collecting ducts, have excessively finely granular, powdery pigment. The nuclei are not compromised except where the pigment is particularly dense—in which case the nucleus is somewhat pyknotic. There are no hair follicles or sebaceous glands in this section. Even the involuntary muscle around the sweat tubule is stained a diffuse brown. The arrectores pilorum muscles and also the involuntary fibers in the vessel walls have escaped involvement. In the lumina of the sweat glands is a rather shreddy, diffusely brown tinted material with some granules. One peculiar feature is the "backing up" or retention in the stratum granulosum of the above mentioned pigment.

Slide No. 2801, J. T., a section of leukoderma and adjacent normal skin stained with hematoxylin and eosin.

This section is the same as the one above, but the area of intense hyperpigmentation is more extensive. There is a lymphocytic proliferation around one blood vessel. There is a very marked number of chromatophores in the tips of the derma papillae. The pigment is intercellular in the basal layer and evidently located in the dendritic processes. The sweat gland cells are dopa positive (as noted in section 2802 above), but without pigment grains in these cells.

Summary of biopsy findings.—The melanin pigment is present in chromatophores which occupy the dermal papillae and in the intercellular spaces of the basal layer of the epidermis. There are also small quantities of pigment within the cytoplasm of the basal cells. The dopa reaction brings out (in addition to the findings under hematoxylin and eosin staining) that the cells of the granular layer of the epidermis are dopa positive. There are dopa positive granules in the stratum corneum and in the secretory cells of the sweat glands.

The following are reports from different sections made by Dr. J. W. Miller, of the United States Public Health Service:

2801, J. T. (fig. 13). Normal skin and leukoderma. Sections treated with dopa show a rather sharp demarcation between the area of leukoderma and normal

skin. There is a gradual decrease in the number of pigment particles in the cells of the basal layer as the leukodermic area is approached. Dopa positive particles occur in cells of the stratum granulosum, cells of the sweat glands and as intra and extracellular particles in the dermis and as isolated particles in the stratum corneum.

A similar picture is noted in sections stained with hematoxylin and eosin (fig. 14). Fine melanin particles also occur in the stratum germinativum and are apparently extracellular. Such particles are also noted in the dermis in connective tissue cells and in small stellate cells under both normal and leukodermic areas.

2802. Repigmented. Dopa treated sections showed areas containing many dense staining dopa particles shading into areas with no particles in the basal cells. In corresponding hematoxylin and eosin sections much less pigment was noted in the basal cells. Pigment particles also occurred in the stratum granulosum. This section is very similar to 2804. Pigment particles occur in the stratum corneum overlying the pigmented areas, but not over the nonpigmented areas.

2803, O. M. Mc. Normal and leukoderma (fig. 15). Dopa positive particles are found in the pigmented basal cell layer of the normal skin portion of the section. At the junction of the area of leukoderma and normal skin there is a preponderance of dopa positive particles in the last four or five cells before a sharp line of demarcation between the normal and leukoderma area. No dopa positive particles occur in the basal layer of the area of leukoderma.

Dopa positive particles are noted in the dermis of the nonpigmented area, both isolated and some apparently in cells.

The same tissue stained with hematoxylin and eosin shows a similar sharp line of demarcation between the pigmented and nonpigmented cells of the basal layer, but the last few cells of the pigmented portions contain fewer pigment particles than the adjacent cells in the normal pigmented portion. Melanin particles appear throughout the dermis under both portions of the section. Other than absence of pigment, no pathological changes are noted.

2804. Repigmented (fig. 16). Areas of dopa positive particles in the basal cell layer are interspersed by areas of pigment-free cells. There is variation in size of these areas. No dopa positive particles are found in the depigmented regions. There is a gradual shading in the pigmentation from either zone. Sections stained with hematoxylin and eosin show a similar picture. The amount of melanin in the basal cell layer of the repigmented portion is less than that noted in the normal skin in the other section from the same case. No inflammatory reaction was present in the sections studied.

Discussion

THEORIES OF ANTIOXIDANT ACTION IN RUBBER

Although the action of antioxidants in rubber is not well understood there are several theories in this regard. One theory is that the antioxidant, having a stronger affinity for oxygen than the rubber, becomes oxidized before the rubber. The fact that antioxidants in rubber lose their action after a time seems to substantiate this theory. Another theory is that, although the antioxidant takes up the oxygen to which the rubber is exposed, it rapidly gives it up in an inactive form. If this were entirely true, the action of the antioxidant would last indefinitely. A third theory is that the presence of the antioxidant in the rubber prevents oxidation of the rubber taking place, although

the antioxidant itself is not acted upon. In other words, it acts like a negative catalyst. If this were true, the presence of the antioxidant would again prevent the rubber from deteriorating at all. However, antioxidants in rubber lose their action after a time, as is evidenced by the rubber becoming sticky, resinous, and losing its tensile strength and elasticity, despite the presence of even large amounts of antioxidant. The fact that the antioxidant is used up in the rubber is proved by experiments which show that more antioxidant can be recovered from newly compounded rubber than from old rubber. Experiments have shown that about 90 percent of the antioxidant freshly placed in rubber can be recovered, whereas very much less than this can be recovered from old rubber. The oxidation products of the usual antioxidants are dark colored compounds. The oxidation product of monobenzyl ether of hydroquinone is much lighter in color than are the oxidation products of other antioxidants. Sunlight plays an active part in causing the oxidation of antioxidants. This is proven by the fact that in the absence of sunlight, antioxidants do not darken as much as when sunlight is present. The amount of antioxidant placed in rubber depends upon the required service of the rubber, the solubility of the antioxidant in the rubber, the effect of the antioxidant on the rubber matrix, and the cost. The more antioxidant up to a certain amount that there is placed in the rubber, the longer is oxidation of the rubber delayed. But there is always a certain amount of oxidation of the rubber itself taking place in spite of the presence of the antioxidant. In other words, when oxygen is present, most of it will combine with the antioxidant, but some of it will also combine with the rubber.

Heat cure does not affect the action of antioxidants on rubber, nor does it seem to affect their chemical composition. The acid cure, however, causes rapid color changes with most antioxidants, because most antioxidants are attacked by active chlorine compounds. In other words, sulfur chloride oxidizes the ordinary antioxidants. Acid cure, however, does not affect monobenzyl ether of hydroquinone as much as it does other antioxidants, and does not cause it to discolor. This is the reason why this antioxidant is used in light-colored, acid-cured rubber goods.

The action of monobenzyl ether of hydroquinone on the skin in producing leukoderma may very well be the same as it is in preventing the oxidation of rubber. The melanin of the skin is theoretically supposed to be formed by the oxidation of the propigment with a special oxidase. Monobenzyl ether of hydroquinone, being absorbed into the skin because of its solubility, prevents this oxidation from taking place. That monobenzyl ether of hydroquinone itself is used up in this process is shown by the fact that after the workers were no

longer exposed to monobenzyl ether of hydroquinone, the pigment returned.

The biopsies do not show any injury to the cells theoretically involved in the melanin production. This despite the fact that some of the workers stated that they had a dermatitis before the leukoderma developed, and one of the authors (L. S.) developed a marked sensitivity to monobenzyl ether of hydroquinone after having applied it to his skin and had a marked dermatitis over the area before the development of leukoderma. There was no scarring following the sensitization dermatitis in any of the cases.

Antioxidants have been used in rubber for many years, but never before has leukoderma been reported from wearing rubber goods. Therefore, it seems either that monobenzyl ether of hydroquinone has a physiologic action on the skin different from that of other antioxidants, or that other antioxidants do not act on the skin. The action of monobenzyl ether of hydroquinone in rubber differs from that of other antioxidants in that it allows less discoloration of the rubber. This is because the oxidation compound of monobenzyl ether of hydroquinone does not darken as much as do the oxidation compounds of other antioxidants. The reason why monobenzyl ether of hydroquinone causes leukoderma, and leukoderma has not been reported to have been caused by other antioxidants, which like monobenzyl ether of hydroquinone discolor only slightly upon oxidation, may be because monobenzyl ether of hydroquinone is more soluble in water and hence more readily absorbed. It is also possible that these other antioxidants have not been used in rubber goods which are worn next to the skin for long periods of time. Monobenzyl ether of hydroquinone is quite freely soluble in alkalies, and the fact that most of the workers who developed leukoderma from wearing the rubber gloves worked with alkalies may have been a factor in dissolving the antioxidant from the rubber and allowing it to come in contact with the skin in an absorbable state.

It was first thought that perhaps there was an excess of monobenzyl ether of hydroquinone in the rubber which caused it to bloom out and come in contact with the skin and thus be absorbed, but an examination by competent rubber chemists of the rubber gloves containing it did not show any bloom. It was then thought that perhaps the antioxidant was dissolved out of the rubber by the perspiration, and to test this a piece of the rubber glove containing monobenzyl ether of hydroquinone was soaked in water containing sufficient acetic acid so that the solution had a pH of 4, and another piece was soaked in water containing a sufficient amount of alkali to give it a pH of 8, these being about the limits of the range of the pH of the perspiration. To 100-cc. of each solution in a 200-cc. flask were added 5 grams of the rubber gloves cut into thin strips. Since the

maximum concentration of antioxidant in the rubber compound was 0.2 percent, this amount of rubber contained 10 milligrams of monobenzyl ether of hydroquinone. At the end of 14 days each of these two solutions extracted 1 milligram of the antioxidant from the rubber, or about 10 percent of all the antioxidant contained in the rubber was taken out by these solutions. This experiment showed that perspiration, regardless of its pH, could dissolve monobenzyl ether of hydroquinone out of the rubber. It is possible that if the rubber had been left in the solution for a longer period of time, the water would have taken more of the antioxidant out of the rubber, perhaps even the entire amount, because 100 cc. of water is capable of dissolving 100 milligrams of monobenzyl ether of hydroquinone, or about 10 times the amount that was contained in the 5 grams of rubber. This experiment proved that the perspiration of the workers could dissolve this antioxidant out of the rubber gloves which they wore.

The workers exposed to the antioxidant in the rubber gloves wore the gloves for many months before leukoderma developed. In this period of time it was possible that the perspiration dissolved a considerable amount of monobenzyl ether of hydroquinone out of the rubber, and that some of this was absorbed into the skin. This hypothesis is made even more plausible because the workers all worked in alkalies in which the monobenzyl ether of hydroquinone is very much more soluble than it is in water.

In the experiments in which we moistened the sample of the glove with the tanning liquids and performed patch tests, and obtained no leukoderma, it was found that the glove with which we performed the patch test was manufactured many months after the monobenzyl ether of hydroquinone had been taken out of the rubber stock. This accounts for the fact that we failed to obtain positive patch tests or leukoderma from the experiment.

The action of monobenzyl ether of hydroquinone in the skin may very well be the same as it is in the rubber, that is to prevent the formation of color compounds, i. e., the formation of melanin in the skin. This may be due to the monobenzyl ether of hydroquinone uniting with dopa oxidase to form a colorless compound, and thus preventing the dopa oxidase from combining with propigment to form melanin. Or the monobenzyl ether of hydroquinone may so injure the melanoblasts that they cannot produce oxidase. Or the monobenzyl ether of hydroquinone may prevent the formation of propigment or even destroy it. That the inhibition of propigment formation, or its destruction, is not the cause of leukoderma in these cases is shown by the fact that the dopa reaction is negative. The dopa reagent theoretically takes the place of propigment, and if free oxidase were present in the cell, the dopa reaction would have been positive. There are no direct reactions known at present which may be used

to determine whether propigment is or is not present. If it were possible to supply the dopa oxidase to frozen sections as it is possible to supply dopa to them, we might be able to ascertain whether or not propigment is present. Since the dopa reaction was negative in the biopsied sections of leukoderma, the propigment cannot be the missing factor in the leukodermic skin.

Therefore, it must be either that the oxidase producing power of the cell is injured or that the monobenzyl ether of hydroquinone prevents the oxidase from forming a color compound with the propigment. The fact that the cells were not injured is shown by the biopsies. The cells appear normal except for their lack of pigment. Therefore, there only remains the theory that the antioxidant prevents the combination of oxidase and propigment. Whether the monobenzyl ether of hydroquinone acts as a negative catalyst in preventing the combination of oxidase with propigment or whether it actually combines with the oxidase itself can only be theoretically surmised. It is also possible that the antioxidant may combine with the oxidase and then give it up in an inactive form, the antioxidant then being capable of combining with more oxidase, etc. Whether it acts in this manner or as a negative catalyst, once in the cell its action would continue indefinitely and repigmentation would not take place even though exposure to more of the antioxidant was prevented, unless metabolism removed the antioxidant from the cell. The fact that repigmentation took place after the antioxidant was removed from the rubber glove shows either that the monobenzyl ether of hydroquinone had been completely oxidized by oxidase and became inactive, or that it was removed by metabolism. In rubber the antioxidant combines with oxygen and is used up in that manner; hence it seems reasonable to suppose that this same action takes place in the skin.

Monobenzyl ether of hydroquinone is not a pigment bleach. It does not decolorize melanin, but simply acts to prevent the formation of melanin. The depigmentation does not appear until the melanin already present in the skin has been absorbed or destroyed by the metabolism. That this takes a considerable length of time is shown by the fact that the leukoderma did not appear in most of the cases until weeks or months after the application of monobenzyl ether of hydroquinone. If it takes such a long period for the melanin to disappear from the skin, it is conceivable that it takes an equal period for a deposit of monobenzyl ether of hydroquinone to disappear from the skin. This accounts for the many months elapsing after cessation of contact with it, before the leukodermic areas showed repigmentation.

It may be possible that other antioxidants would produce leukoderma if they could be absorbed by the skin. Perhaps if they were dissolved in a vegetable or animal oil and applied to the skin they

could produce leukoderma. But the depigmentation would not be as apparent as that produced by monobenzyl ether of hydroquinone, because the oxidation products of other antioxidants are not colorless compounds, and just as they cause discoloration of rubber they would cause discoloration of the skin and prevent the observation of the disappearance of the melanin.

It was noted in our experiments and in the cases of leukoderma studied that the hairs in the leukodermic areas were not decolorized. This points to a separate pigment-forming mechanism for the skin and hairs. There is, however, a possibility that the antioxidant did not penetrate to the deeply placed hair papillae. But the fact that senile graying of the hair occurs without concomitant loss of pigment in the skin tends to corroborate the theory of separate pigment-forming mechanisms for skin and hair.

As to the use of monobenyzl ether of hydroquinone for bleaching the skin or decolorizing hyperpigmented areas, it must be borne in mind that it takes a long time for depigmentation to be produced by this antioxidant. Moreover, there is a possibility of its action spreading to the surrounding normal skin and depigmenting a larger area than was intended. The fact that sensitization to it was produced in some individuals (produced on L. S.) must also be borne in mind.

Summary

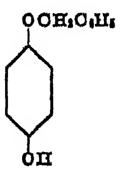
An outbreak of leukoderma among the workers in a tannery was investigated.

It was found that about 50 percent of those wearing a heavy acid-cured rubber glove were affected.

Investigations showed that a considerable percentage of workers wearing the same make of glove in other tanneries and in other industries were similarly affected.

The makers of the glove were traced and their cooperation was obtained in an effort to determine what chemical in the glove caused the leukoderma.

By patch testing with the various chemicals in the glove, it was found that the antioxidant, said by the makers to be monobenzyl ether of hydroquinone,



containing less than 1 percent impurity of unchanged hydroquinone, was the cause of the leukoderma.

It was proved that the impurity of hydroquinone was not a factor in causing the leukoderma.

Repigmentation of the leukodermic areas followed the withdrawal of the antioxidant from the rubber glove.

The fact that the hairs in the leukodermic areas were not depigmented suggests that there may be a separate pigment-forming mechanism for the skin and the hairs.

Leukoderma was experimentally produced on normal skin by long-continued application of this compound.

In some instances allergic reactions were elicited by long-continued applications of the compound.

The theories of the action of antioxidants in rubber are discussed.

It seems likely that the action of the antioxidants in the skin is similar to their action in rubber.

The possibility of using antioxidants for the depigmentation of hyperpigmented areas of the skin is suggested.

The general health of the workers was not affected.

TABLE 3.—*Laboratory studies on workers having leukoderma made at beginning of investigation*

Patient No.	pH of surface of skin	Wassermann test	Kahn test	Red blood cells, in millions	Hemoglobin percentage, based on 15.3 gm.	Hemoglobin, gm. per 100 cc.	Color index	Reticulocytes per 100 red cells
1201	------------	–	–	4.56	81.9	12.6	0.89	0.06
1202	------------	(1)	–	4.86	90.9	14.1	0.9	0.04
1203	------------	–	–	4.69	84.5	13.9	0.9	0.24
1204	5.0+ to 5.7	(1)	–	4.74	92.8	14.8	0.9	0.13
1205	5.0+ to 5.7	–	–	4.75	92.8	14.8	0.9	0.14
1206	------------	–	–	4.86	85.8	13.2	0.89	0.1
1207	5.0+ to 5.7	–	–	5.30	102.8	15.8	0.9	0.14
1208	5.9	(1)	–	5.02	79.4	12.2	0.79	0.08
1209	------------	–	–	5.11	101.8	15.6	0.9	0.89
1210	------------	–	–	4.86	90.8	13.9	0.9	0.1
1211	------------	(1)	–	5.05	78.1	12	0.78	0.2
1212	5.0+ to 5.7	–	–	4.78	90.0	14.1	0.9	0.14
1213	------------	–	–	5.09	90.8	13.9	0.9	0.09
1214	------------	–	–	4.89	95.2	14.6	0.9	0.17
1215	------------	–	–	4.96	80	12.8	0.8	0.24
1216	------------	(3)	(3)	4.56	87.1	13.4	0.9	0.1
1217	------------	–	–	4.86	87.1	13.4	0.9	0.18
1218	5.0+ to 5.7	(1)	(1)	4.86	83.9	12.0	0.8	0.08

Patient No.	White blood cells	Neutrophiles	Eosinophiles	Lymphocytes	Monocytes	Immature (staff)
1201	5,800	52	1	42	3	2
1202	4,600	60	3	36	1	0
1203	8,600	76	2	22	0	0
1204	7,900	65	2	32	1	0
1205	7,200	62	6	29	2	1
1206	7,100	43	0	55	1	1
1207	6,800	42	1	51	6	0
1208	11,700	67	0	23	7	3
1209	5,800	67	4	26	3	0
1210	7,100	53	1	43	0	3
1211	4,300	56	3	37	4	0
1212	8,000	78	1	17	4	0
1213	7,400	61	1	32	6	0
1214	5,100	65	1	33	1	0
1215	9,600	57	3	36	1	0
1216	7,100	57	3	30	5	0
1217	5,100	53	4	40	3	0
1218	5,600	77	1	19	3	0

[1] Anticomplementary. [2] Positive. [3] Strongly positive.

NOTE.—In all the above cases the red blood cells were normal in size and shape, with no stippling or polychromatophilia.

PROVISIONAL BIRTH AND INFANT MORTALITY STATISTICS FOR 1939

BIRTHS

According to provisional tabulations issued by the Bureau of the Census,[1] there were 2,262,726 births registered in the United States in 1939, a decrease of 24,236 as compared with 1938. This decrease in the number of births gives a corresponding decrease in the birth rate from 17.6 to 17.4. The provisional rate for 1939, however, is approximately 5 percent higher than the lowest birth rate, 16.5 in 1933, recorded for the birth registration area since that area was established in 1915, which is probably also the lowest rate for the country as a whole. The Bureau of the Census points out that the slight increases in the last 2 years cannot be taken as an assurance that the general decline in the birth rate in the United States during the past 20 years has been checked.

On the basis of provisional figures, 16 States and the District of Columbia show an increase in 1939 over 1938, 27 States show a decrease, and in 5 States there was no change. The largest increases are shown for the District of Columbia, Delaware, Florida, and South Carolina, while the largest decreases are recorded for Mississippi, Arkansas, and Illinois.

The highest birth rates for 1939 are those for New Mexico (33.7), Arizona (26.0), Mississippi (25.6), and Utah (25.1), while the lowest rates are shown for New Jersey (13.0), Connecticut (13.5), Massachusetts (13.6), and New York (14.4).[2]

The final birth rates, by States, will be published in the Public Health Reports as soon as they are made available by the Bureau of the Census.

The following table gives the birth rates for the expanding birth registration area in continental United States from 1915 to 1939. Since, and including, 1933, the birth registration area includes all of the States.

Birth rate (number of live births per 1,000 population) for the birth registration area, 1915–39

Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate
1939 [1]	17.4	1934	17.1	1929	18.9	1924	22.4	1919	22.3
1938	17.6	1933	16.5	1928	19.8	1923	22.2	1918	24.6
1937	17.0	1932	17.4	1927	20.6	1922	22.3	1917	24.7
1936	16.7	1931	18.0	1926	20.7	1921	24.2	1916	25.0
1935	16.9	1930	18.9	1925	21.5	1920	23.7	1915	25.1

[1] Provisional.

[1] Vital Statistics—Special Reports, vol. 9, No. 46 (May 22, 1940), pp. 537–542.

[2] The rates for the States are based on the estimated State populations for 1937; the rates for the United States are based on the estimated population for 1938. The birth figures for Massachusetts are partial estimates, as the 1939 data are incomplete.

INFANT MORTALITY

Provisional figures furnished by the Bureau of the Census [3] indicate that the infant mortality rate for the United States in 1939 is the lowest in the history of the birth registration area and no doubt the lowest for the country as a whole. According to provisional tabulations, there were 108,532 infant deaths (under 1 year of age) in the United States in 1939, as compared with 116,702 in 1938. The corresponding infant mortality rates (number of deaths under 1 year of age per 1,000 live births) are 48.0 and 51.0—a reduction of 6 percent in 1939 as compared with the preceding year.

In terms of the infant mortality rate, 42 States and the District of Columbia recorded decreases in 1939 as compared with 1938, while 6 States showed increases. A comparison of the rates for cities with a population of 100,000 or more shows decreases in 65 cities, increases in 27, and the same rate for the 2 years in 1 city.

Fourteen States have rates below 40.0, the lowest rate, 35.4, being reported for Minnesota. The highest rates are those for New Mexico, 109.3, and Arizona, 95.5.

As the figures for 1939 are preliminary, and in some instances probably incomplete, the numbers of infant deaths and the infant mortality rates by States will not be published in the Public Health Reports until final tabulations are available. It is unlikely that delayed certificates and the final count will change the provisional rate for the country as a whole.

The general trend of the infant mortality rate in the United States since 1915 is shown in the following table:

Infant mortality rate (number per 1,000 live births) for the birth registration area, by years, 1915–39

Year	Rate	Year	Rate	Year	Rate	Year	Rate	Year	Rate
1939 [1]	48 0	1934	60 1	1929	67.6	1924	70.8	1919	86 6
1938	51.0	1933	58.1	1928	68.7	1923	77.1	1918	100.9
1937	54 4	1932	57.6	1927	64.6	1922	76.2	1917	93.8
1936	57.1	1931	61.6	1926	73.8	1921	75.6	1916	101.0
1935	55.7	1930	64.6	1925	71.7	1920	85.8	1915	99.9

[1] Provisional.

COURT DECISION ON PUBLIC HEALTH

Statute requiring health certificate of person working in food or drink establishment construed.—(Texas Court of Criminal Appeals; *Sekaly* v. *State*, 136 S.W.2d 854; decided February 14, 1940.) A Texas law provided in part as follows:

[3] Vital Statistics—Special Reports, vol. 9, No. 47 (May 25, 1940), pp. 543–547.

> No person * * * operating * * * any * * * place * * * where food or drink * * * is * * * served, sold, or * * * handled * * * shall work, employ, or keep in their employ, in * * * said place * * * any person infected with any transmissible condition of any infectious or contagious disease, or work, or employ any person to work in * * * said place, * * * who, at the time of his * * * employment, failed to deliver to the employer * * * a certificate signed by a * * * physician * * * attesting the fact that the bearer had been * * * examined by such physician within a week prior to the time of such employment, and that such examination disclosed the fact that such person to be employed was free from any transmissible condition of any infectious or contagious disease.

The act also required that a new certificate be secured every 6 months.

In a prosecution under this law it was charged that, on or about a certain date, an operator of an establishment, where food and drink were served, unlawfully worked in said establishment without having in his possession a physician's certificate showing that he had been examined by such physician within 1 week prior to the time that he so worked in said establishment and that such examination disclosed that he was free from any infectious and contagious disease. There was a conviction and an appeal followed.

In considering the case on appeal the court of criminal appeals said that it occurred to it that the statute required that a certificate be secured not more than 1 week prior to the time of employment and be renewed every 6 months, but that it was not necessary that a certificate show that it was secured 1 week prior to any particular time that the operator or employee might have worked. "The law," said the court, "does not seem to require the operator or employee of the establishment to have a certificate attesting the fact that he or she has been examined by a physician within a week prior to any particular time that he might have worked in such establishment." The court pointed out that it was merely alleged that the appellant worked in the establishment on a particular date without having secured a certificate for a week prior to this date.

Regarding the allegation that the appellant did not have a certificate in his possession, the court said that the statute did not require that an employee or operator have actual possession of a certificate but that it only required that the certificate be displayed on the business premises.

The judgment of the lower court was reversed and the prosecution ordered dismissed.

DEATHS DURING WEEK ENDED JUNE 8, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended June 8, 1940	Correspond-ing week, 1939
Data from 88 large cities of the United States:		
Total deaths	8,579	7,950
Average for 3 prior years	7,773	
Total deaths, first 23 weeks of year	208,252	206,928
Deaths under 1 year of age	521	490
Average for 3 prior years	486	
Deaths under 1 year of age, first 23 weeks of year	11,601	12,124
Data from industrial insurance companies		
Policies in force	65,353,394	67,253,770
Number of death claims	12,771	12,798
Death claims per 1,000 policies in force, annual rate	10 2	9 9
Death claims per 1,000 policies, first 23 weeks of year, annual rate	10 4	11 4

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JUNE 15, 1940

Summary

The incidence of smallpox, typhoid fever, and whooping cough increased slightly during the week ended June 15, as compared with the preceding week, while that of the other 6 important communicable diseases included in the weekly telegraphic reports decreased. The numbers of cases for each of these 9 diseases, however, with the exception of measles, were below the 5-year (1935–39) median expectancy for the current week, and, with the exception of measles, scarlet fever, and whooping cough, were below the figures for the corresponding week last year.

The number of cases of smallpox increased from 62 to 78, of which 71 cases, or 91 percent, were reported from the two North Central groups of States (18 in North Dakota, 14 each in Illinois and Wisconsin, and 10 each in Indiana and Iowa).

The 154 cases of typhoid fever reported currently (preceding week, 130; 5-year median, 292) were more widely scattered, with the 4 West South Central States reporting 46 cases, Georgia 13, Missouri 12, and the 3 Pacific States 14 (California 10).

The number of reported cases of poliomyelitis dropped from 58 to 42, and of meningococcus meningitis from 29 to 24. Of the 42 cases of poliomyelitis, 28 cases, or 67 percent, occurred in two Pacific States, Washington (17, of which 14 were in Pierce County, 2 in Tacoma) and California (11, of which 6 were in Los Angeles).

Of 12 cases of Rocky Mountain spotted fever, 8 cases were reported in the western States and 4 cases in the East. Ten cases of Colorado tick fever were reported in Colorado; 2 cases of undulant fever each in Rhode Island and Arizona, and 3 cases in Maryland; and 2 cases of tularaemia in Utah. Of 20 cases of endemic typhus fever, 10 cases were reported in Texas.

For the current week the Bureau of the Census reports 7,956 deaths in 88 major cities of the United States, as compared with 8,579 for the preceding week and with a 3-year (1937–39) average of 7,623 for the corresponding week.

Telegraphic morbidity reports from State health officers for the week ended June 15, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	June 15, 1940	June 17, 1939		June 15, 1940	June 17, 1939		June 15, 1940	June 17, 1939		June 15, 1940	June 17, 1939	
NEW ENG.												
Maine	1	3	1	2	1	------	305	63	81	0	0	0
New Hampshire	0	1	0	------	------	------	6	33	33	0	0	0
Vermont	0	0	0	------	------	------	8	201	47	0	0	0
Massachusetts	4	0	2	------	------	------	1,455	1,015	460	0	1	1
Rhode Island	0	0	0	------	------	------	201	26	26	0	0	1
Connecticut	1	0	2	1	------	------	31	408	213	1	1	1
MID. ATL.												
New York	16	14	34	[1] 1	[1] 6	[1] 3	994	1,511	2,546	3	4	13
New Jersey [2]	1	15	10	3	4	4	1,267	32	517	0	1	3
Pennsylvania	15	14	18	------	------	------	496	124	1,408	3	7	7
E. NO. CEN.												
Ohio	9	10	13	12	28	28	53	96	898	1	1	1
Indiana	4	4	4	5	1	3	16	6	97	2	0	1
Illinois	19	19	37	5	9	10	223	33	427	2	0	3
Michigan [3]	2	5	6	1	2	1	793	301	189	0	1	2
Wisconsin	1	0	1	15	31	11	1,111	457	457	0	0	1
W. NO. CEN.												
Minnesota	1	1	1	2	2	2	86	138	190	0	0	0
Iowa	5	8	2	------	1	1	87	100	100	0	0	1
Missouri	2	5	7	1	------	22	21	3	50	0	0	0
North Dakota	3	1	1	------	10	------	3	5	5	0	0	0
South Dakota	0	0	0	1	3	------	2	57	3	0	0	0
Nebraska	0	1	1	------	4	------	7	110	89	0	1	1
Kansas	1	3	3	1	2	1	242	59	59	1	0	0
SO. ATL.												
Delaware [2]	0	0	1	------	------	------	3	12	9	0	1	0
Maryland [2] [3]	0	2	3	------	2	1	9	120	120	0	0	1
Dist. of Col.	0	0	8	------	------	------	6	144	93	0	0	3
Virginia [2]	5	10	7	34	32	------	156	446	183	0	1	4
West Virginia [3]	2	2	4	7	9	11	10	14	95	0	1	1
North Carolina [4]	6	9	7	------	------	1	112	288	196	0	1	4
South Carolina [4]	3	3	3	95	188	56	16	14	30	0	2	2
Georgia [4]	1	7	3	9	17	------	43	60	0	1	0	0
Florida [4]	2	6	6	------	4	1	16	47	11	0	0	0
E. SO. CEN.												
Kentucky	2	2	4	2	------	5	95	20	65	1	0	1
Tennessee	2	3	5	21	22	8	85	101	49	0	3	3
Alabama [4]	1	1	5	10	22	8	81	81	68	1	1	1
Mississippi [3]	0	3	5	------	------	------	------	------	------	0	0	0
W. SO. CEN.												
Arkansas	3	1	3	28	13	10	28	31	81	0	1	1
Louisiana [4]	0	5	10	9	9	15	1	14	14	1	0	3
Oklahoma	5	2	2	13	17	17	22	78	48	1	0	1
Texas [4]	14	30	26	100	91	91	669	309	125	2	1	1
MOUNTAIN												
Montana	2	0	0	------	2	2	50	84	56	0	0	0
Idaho	0	0	0	------	------	------	31	22	19	0	0	0
Wyoming [3]	1	0	0	------	------	------	34	34	5	0	0	0
Colorado [5]	10	6	4	------	20	------	26	56	56	0	0	0
New Mexico	0	2	2	------	1	1	67	17	46	0	0	0
Arizona	2	1	2	50	33	14	71	8	8	1	0	0
Utah [2] [3]	0	0	0	------	------	------	222	92	77	0	0	0
PACIFIC												
Washington [3]	2	2	0	------	------	------	187	769	199	0	0	1
Oregon [3]	5	0	1	5	19	7	111	56	56	0	0	0
California [2] [4]	20	21	30	23	36	110	260	1,455	1,007	3	2	3
Total	173	217	330	456	641	540	9,708	9,210	9,239	24	31	64
24 weeks	7,427	9,773	11,648	165,861	148,631	138,052	193,411	322,064	322,064	903	1,108	3,403

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 15, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	June 15, 1940	June 17, 1939		June 15, 1940	June 17, 1939		June 15, 1940	June 17, 1939		June 15, 1940	June 17, 1939	
NEW ENG.												
Maine	0	0	0	0	11	7	0	0	0	1	0	1
New Hampshire	0	0	0	1	1	3	0	0	0	0	1	0
Vermont	1	0	0	1	7	5	0	0	0	0	0	0
Massachusetts	0	1	1	95	109	188	0	0	0	1	6	1
Rhode Island	0	0	0	4	3	11	0	0	0	1	2	0
Connecticut	0	0	0	48	26	77	0	0	0	1	3	1
MID. ATL.												
New York	1	2	2	389	267	447	0	8	0	7	10	9
New Jersey [2]	1	0	1	147	101	101	0	0	0	2	0	4
Pennsylvania	1	1	0	195	150	261	0	1	0	9	6	12
E. NO. CEN.												
Ohio	0	0	1	142	172	172	0	14	4	4	8	8
Indiana	1	1	0	37	51	53	10	4	4	3	8	8
Illinois	1	1	1	444	173	319	14	9	12	3	13	6
Michigan [3]	0	1	0	211	257	257	0	3	1	1	3	4
Wisconsin	0	0	0	79	50	185	14	0	3	0	1	1
W. NO. CEN.												
Minnesota	0	0	0	44	29	89	0	2	7	0	0	1
Iowa	0	0	0	28	40	54	10	12	19	1	3	8
Missouri	0	0	1	46	38	38	2	8	10	12	4	7
North Dakota	0	0	0	2	0	11	18	3	8	0	0	0
South Dakota	1	0	0	3	7	8	1	7	7	1	0	0
Nebraska	0	0	0	2	6	9	1	6	6	0	0	0
Kansas	2	0	0	21	25	45	1	7	8	3	2	2
SO. ATL.												
Delaware [2]	0	0	0	2	7	3	0	0	0	0	0	0
Maryland [2,3]	0	0	0	20	7	43	0	0	0	2	2	4
Dist. of Col	0	0	0	12	4	7	0	0	0	1	3	0
Virginia [2]	0	0	0	25	16	18	0	0	0	3	13	13
West Virginia [3]	0	0	0	23	22	22	1	0	0	3	9	6
North Carolina [4]	0	2	2	11	18	18	0	4	1	0	11	11
South Carolina [4]	0	28	0	0	0	1	1	0	0	1	21	12
Georgia [4]	0	5	0	6	8	5	0	0	0	13	12	23
Florida [4]	1	1	0	2	5	5	0	0	0	4	2	4
E. SO. CEN.												
Kentucky	1	0	0	21	12	13	0	2	0	2	12	9
Tennessee	1	0	0	26	21	10	0	14	0	2	10	13
Alabama [4]	1	0	2	6	11	5	1	0	0	3	5	10
Mississippi [3]	0	0	1	4	2	6	0	0	0	2	1	7
W. SO. CEN.												
Arkansas	0	0	0	4	3	4	0	2	0	7	7	8
Louisiana [4]	0	0	1	10	9	6	0	0	0	11	11	13
Oklahoma	1	0	0	16	5	11	0	12	1	10	15	11
Texas [4]	0	2	2	18	23	28	2	0	7	18	16	19
MOUNTAIN												
Montana	0	0	0	5	9	8	0	0	7	0	0	1
Idaho	0	0	0	2	1	7	0	0	0	2	0	1
Wyoming [3]	0	0	0	5	0	6	0	4	3	0	0	0
Colorado [5]	0	1	0	13	20	29	1	2	2	1	4	1
New Mexico	0	1	0	5	15	15	0	0	0	4	9	1
Arizona	0	4	0	3	1	7	0	0	0	0	1	2
Utah [2,3]	0	0	0	5	12	15	0	0	0	1	0	0
PACIFIC												
Washington [3]	17	0	0	31	20	25	0	1	3	3	52	2
Oregon [2]	0	1	0	6	18	16	1	1	5	1	1	2
California [2,4]	11	13	6	105	98	149	0	70	14	10	5	10
Total	42	65	65	2,325	1,890	3,033	78	196	196	154	292	292
24 weeks	644	630	575	100,589	107,943	152,197	1,685	8,072	7,078	2,242	3,233	3,233

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 15, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Whooping cough, week ended June 15, 1940	Whooping cough, week ended June 17, 1939
NEW ENG.		
Maine	18	44
New Hampshire	2	0
Vermont	15	46
Massachusetts	156	121
Rhode Island	10	13
Connecticut	44	68
MID. ATL.		
New York	259	427
New Jersey [2]	88	281
Pennsylvania	257	303
E. NO. CEN.		
Ohio	300	320
Indiana	27	42
Illinois	96	179
Michigan [3]	237	168
Wisconsin	100	143
W. NO. CEN.		
Minnesota	21	28
Iowa	23	28
Missouri	55	18
North Dakota	15	1
South Dakota	0	2
Nebraska	8	34
Kansas	43	14
SO. ATL.		
Delaware [2]	7	17
Maryland [2 3]	152	46
Dist. of Col	5	30
Virginia [2]	56	123
West Virginia [3]	31	16
North Carolina [4]	122	203
South Carolina [4]	17	73
SO. ATL.—continued		
Georgia [4]	54	18
Florida [4]	5	28
E. SO. CEN.		
Kentucky	107	12
Tennessee	59	50
Alabama [4]	19	62
Mississippi [3]		
W. SO. CEN.		
Arkansas	17	33
Louisiana [4]	76	3
Oklahoma	27	4
Texas [4]	261	146
MOUNTAIN		
Montana	0	6
Idaho	11	5
Wyoming [2]	3	0
Colorado [5]	5	49
New Mexico	45	17
Arizona	48	34
Utah [2 3]	179	55
PACIFIC		
Washington [2]	50	29
Oregon [2]	35	16
California [2 4]	471	181
Total	3,612	3,535
24 weeks	76,890	94,166

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended June 15, 1940, 12 cases, as follows: New Jersey, 1; Delaware, 1; Maryland, 1; Virginia, 1; Wyoming, 3; Utah, 2; Washington, 1; Oregon, 1; California, 1.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended June 15, 1940, 20 cases, as follows: North Carolina, 1; South Carolina, 1; Georgia, 3; Florida, 2; Alabama, 1; Louisiana, 1; Texas, 10; California, 1.
[5] Colorado tick fever, week ended June 15, 1940, Colorado, 10 cases.

PLAGUE INFECTION IN RODENTS AND FLEAS IN OREGON AND WASHINGTON

IN A MARMOT IN LAKE COUNTY, OREG.

Under date of May 31, Surgeon L. B. Byington reported plague infection proved in a marmot (*Marmota flaviventris*) shot on May 17, 1940, 7 miles north of Adel, Lake County, Oreg.

IN FLEAS FROM A COTTONTAIL RABBIT IN SPOKANE COUNTY, WASH.

Under date of May 31, Surgeon L. B. Byington reported plague infection proved in a pool of 36 fleas from a cottontail rabbit shot on May 20, 1940, 9 miles west of Spangle, Spokane County, Wash.

WEEKLY REPORTS FROM CITIES

City reports for week ended June 1, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Data for 90 cities:											
5-year average	131	55	26	5,062	464	1,063	18	385	31	1,209	------
Current week [1]	56	31	21	3,389	291	1,594	1	310	19	773	------
Maine:											
Portland	0	-----	0	83	2	0	0	0	0	0	25
New Hampshire:											
Concord	0	-----	0	0	1	0	0	0	0	0	8
Manchester	0	-----	0	0	5	0	0	0	0	0	15
Vermont:											
Barre	0	-----	0	0	0	1	0	2	0	0	3
Burlington	0	-----	0	0	0	0	0	0	0	0	9
Rutland	0	-----	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	0	-----	0	209	19	30	0	11	1	47	218
Fall River	0	-----	0	151	0	1	0	1	0	3	32
Springfield	0	-----	0	3	1	6	0	1	0	5	42
Worcester	0	-----	-----	236	2	11	0	0	1	4	37
Rhode Island:											
Pawtucket	0	-----	0	0	0	0	0	0	0	0	16
Providence	0	-----	0	113	2	4	0	1	0	0	55
Connecticut:											
Bridgeport	0	-----	0	2	3	5	0	2	0	0	28
Hartford	0	-----	0	1	4	6	0	0	0	6	44
New Haven	0	-----	2	0	0	7	0	0	0	6	43
New York:											
Buffalo	2	-----	0	3	7	20	0	2	0	5	135
New York	12	6	2	395	60	427	0	80	4	68	1,443
Rochester	0	-----	1	4	1	9	0	1	0	5	73
Syracuse	0	-----	0	0	1	5	0	0	0	3	47
New Jersey:											
Camden	0	-----	0	3	1	12	0	0	0	0	32
Newark	0	1	0	400	1	20	0	1	0	10	98
Trenton	0	-----	0	0	2	7	0	3	0	2	28
Pennsylvania:											
Philadelphia	0	-----	2	161	14	88	0	17	0	14	376
Pittsburgh	1	-----	1	2	4	35	0	7	0	13	146
Reading	0	-----	0	2	0	0	0	1	0	7	25
Scranton	0	-----	-----	0	-----	0	0	-----	0	0	-----
Ohio:											
Cincinnati	1	2	1	0	0	8	0	8	0	17	112
Cleveland	2	10	1	7	11	50	0	9	0	43	174
Columbus	1		0	0	1	8	0	1	0	2	70
Toledo	0	-----	0	2	1	64	0	3	0	3	51
Indiana:											
Anderson	0	-----	0	1	1	2	0	0	0	0	10
Fort Wayne	0	-----	1	6	1	2	0	0	0	1	22
Indianapolis	0	-----	0	4	5	24	0	6	0	6	99
Muncie	0	-----	0	0	0	0	0	0	0	1	9
South Bend	0	-----	0	0	0	0	0	0	0	0	12
Terre Haute	0	-----	1	0	2	1	0	0	0	2	27
Illinois:											
Alton	0	-----	0	0	1	1	0	1	0	0	11
Chicago	11	3	3	104	21	497	0	36	1	26	630
Elgin	0	-----	0	0	2	1	0	1	0	0	11
Moline	0	-----	0	3	0	0	0	0	0	0	10
Springfield	0	-----	0	1	0	1	0	0	0	0	17
Michigan:											
Detroit	1	-----	0	261	8	88	0	17	1	70	221
Flint	0	-----	0	11	2	8	0	0	0	2	10
Grand Rapids	0	-----	0	3	3	21	0	0	0	17	50
Wisconsin:											
Kenosha	0	-----	0	69	0	0	0	0	0	0	6
Madison	0	-----	0	66	1	1	0	0	0	5	4
Milwaukee	0	-----	0	0	2	24	0	7	0	6	88
Racine	0	-----	0	3	0	3	0	0	0	1	11
Superior	0	-----	0	84	0	2	0	0	0	0	7
Minnesota:											
Duluth	0	-----	0	5	0	0	0	0	0	0	15
Minneapolis	0	-----	1	1	3	14	0	1	0	12	98
St. Paul	0	1	1	0	2	7	0	3	0	8	61

[1] Figures for Boise estimated; report not received.

City reports for week ended June 1, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Iowa:											
Cedar Rapids	0	------	------	38	------	0	0	------	0	1	------
Davenport	0	------	------	3	------	0	0	------	0	0	------
Des Moines	0	------	0	19	0	3	1	0	0	0	38
Sioux City	0	------	------	1	------	1	0	------	0	0	------
Waterloo	1	------	------	5	------	1	0	------	0	1	------
Missouri:											
Kansas City	0	------	0	7	4	5	0	0	1	0	101
St. Joseph	0	------	0	0	0	2	0	1	0	0	24
St. Louis	0	------	0	2	9	12	0	2	0	12	184
North Dakota:											
Fargo	0	------	0	0	0	0	0	0	0	0	6
Grand Forks	0	------	------	0	------	0	0	------	0	2	------
Minot	1	------	0	1	0	0	0	0	0	0	8
South Dakota:											
Aberdeen	0	------	------	0	------	0	0	------	0	0	------
Sioux Falls	1	------	0	0	0	1	0	0	0	0	9
Nebraska:											
Lincoln	0	------	------	1	------	2	0	------	0	1	------
Omaha	6	------	0	9	1	5	0	2	0	1	52
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	1	4
Topeka	0	------	0	30	0	3	0	0	0	0	14
Wichita	0	------	0	3	4	1	0	0	0	0	32
Delaware:											
Wilmington	0	------	0	0	1	2	0	0	0	4	25
Maryland:											
Baltimore	1	------	0	2	5	10	0	13	0	66	200
Cumberland	0	------	0	0	0	1	0	0	0	0	8
Frederick	0	------	0	0	1	0	0	0	0	0	3
Dist. of Col.											
Washington	3	------	0	2	7	20	0	10	1	8	126
Virginia:											
Lynchburg	1	------	0	0	1	0	0	0	0	11	17
Norfolk	0	------	0	104	1	1	0	1	0	3	32
Richmond	0	------	0	3	1	3	0	2	0	0	45
Roanoke	0	------	0	27	0	1	0	0	0	0	15
West Virginia:											
Charleston	0	------	0	1	1	1	0	0	0	1	13
Huntington	0	------	------	0	------	1	0	------	0	0	------
Wheeling	0	------	0	0	2	0	0	2	2	5	13
North Carolina:											
Gastonia	0	------	------	0	------	1	0	------	0	0	------
Raleigh	0	------	0	1	0	0	0	1	0	1	9
Wilmington	0	------	0	1	1	0	0	0	0	0	9
Winston-Salem	1	------	0	0	0	1	0	2	0	4	21
South Carolina:											
Charleston	0	------	0	0	1	0	0	1	0	0	23
Florence	0	------	0	0	0	0	0	2	0	0	12
Greenville	0	------	0	1	3	0	0	1	0	0	21
Georgia:											
Atlanta	0	4	0	4	3	1	0	3	1	5	70
Brunswick	0	------	0	0	0	0	0	0	0	0	1
Savannah	0	------	0	0	1	2	0	2	0	0	25
Florida:											
Miami	0	1	0	2	2	0	0	1	0	0	35
Tampa	0	------	0	39	2	0	0	0	0	1	21
Kentucky:											
Ashland	0	------	0	0	0	0	0	0	0	0	5
Covington	0	------	0	15	0	1	0	0	0	5	13
Lexington	0	------	0	18	0	1	0	0	0	4	15
Louisville	0	------	0	17	4	20	0	3	0	47	57
Tennessee:											
Knoxville	0	2	2	1	2	2	0	0	1	0	30
Memphis	0	------	0	41	5	8	1	3	0	10	67
Nashville	0	------	0	7	3	2	0	2	1	4	41
Alabama:											
Birmingham	0	------	0	14	2	2	0	4	0	3	61
Mobile	0	2	0	21	2	0	0	1	0	0	15
Montgomery	0	------	------	1	------	0	0	------	0	3	------
Arkansas:											
Fort Smith	0	------	------	0	------	0	0	------	1	0	------
Little Rock	0	------	1	0	5	1	0	1	0	5	------
Louisiana:											
Lake Charles	0	------	0	0	0	0	0	0	1	0	5
New Orleans	2	1	1	0	6	1	0	11	1	42	147
Shreveport	0	------	0	1	4	[illegible]	0	2	1	2	38

City reports for week ended June 1, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oklahoma:											
Oklahoma City	0	4	0	0	0	4	0	1	0	0	31
Tulsa	0	------	0	0	2	1	0	1	0	8	22
Texas:											
Dallas	0	------	0	218	4	0	0	2	1	19	56
Fort Worth	0	------	0	16	0	0	0	2	0	26	30
Galveston	0	------	0	0	1	0	0	0	0	0	9
Houston	1	------	0	13	3	1	0	2	0	1	53
San Antonio	1	------	0	3	7	1	0	3	0	7	85
Montana:											
Billings	0	------	0	0	1	0	0	0	0	0	10
Great Falls	0	------	0	21	0	0	0	0	0	0	3
Helena	0	------	0	0	0	1	0	0	0	0	6
Missoula	0	------	0	0	0	1	0	0	1	0	6
Idaho:											
Boise	------	------	------	------	------	------	------	------	------	------	------
Colorado:											
Colorado Springs	0	------	0	1	0	1	0	1	0	0	12
Denver	6	------	0	24	3	2	0	2	0	1	81
Pueblo	0	------	0	5	0	1	0	0	0	1	12
New Mexico:											
Albuquerque	1	------	0	0	1	0	0	2	0	1	17
Utah:											
Salt Lake City	0	------	1	310	1	1	0	0	0	69	34
Washington:											
Seattle	0	------	0	130	4	5	0	3	0	10	86
Spokane	0	------	0	1	0	2	0	0	0	2	20
Tacoma	0	------	0	0	1	5	0	0	0	1	27
Oregon:											
Portland	4	------	0	30	1	0	0	1	0	11	79
Salem	0	------	------	3	------	0	0	------	0	0	------
California:											
Los Angeles	2	1	1	15	2	24	0	8	1	36	238
Sacramento	1	------	0	0	1	1	0	2	0	16	21
San Francisco	0	---	0	7	5	4	0	11	0	14	170

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
New York:			
New York	0	1	0
Rochester	1	0	0
Michigan:			
Detroit	1	0	0
Flint	1	0	0
District of Columbia:			
Washington	1	0	0
West Virginia:			
Huntington	1	0	0
Wheeling	0	0	1
South Carolina:			
Charleston	0	0	1
Florence	0	1	0
Alabama:			
Birmingham	1	0	0
Louisiana:			
New Orleans	1	0	1
Shreveport	0	1	0
Washington:			
Tacoma	0	0	14
California:			
Los Angeles	0	0	5

NOTE.—Information has been received that 1 case reported as meningococcus meningitis in Wilmington, N. C., for the week ended May 11, and published in Public Health Reports of May 31, p. 997, was influenzal meningitis.

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Wichita, 1.

Pellagra.—Cases: Charleston, S. C., 1; Miami, 2; Louisville, 1.

Typhus fever.—Cases: New York, 1; Savannah, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended May 18, 1940.—During the week ended May 18, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				1	4		1			6
Chickenpox		19	14	163	332	32	2	1	64	627
Diphtheria		3	1	23		12	4	1		41
Dysentery				3						3
Influenza		4			21		3		2	30
Lethargic encephalitis					1					1
Measles		11	3	293	299	307	289	13	128	1,433
Mumps		6		9	344	11	15		16	401
Pneumonia		14			29	3	1	3	1	51
Poliomyelitis				2						2
Scarlet fever		5	12	97	91	22	2	20	4	253
Tuberculosis	2	10	8	54	59	1	2			136
Typhoid and paratyphoid fever		2		20	1		31	2		56
Whooping cough		46	13	176	138	39	35	11	10	468

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of May 31, 1940, pages 1000-1002. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

India—Moulmein.—During the week ended June 1, 1940, 10 cases of cholera were reported in Moulmein, India.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Paauilo.—A rat found on May 9, 1940, in Paauilo, Hamakua District, Island of Hawaii, T. H., has been proved positive for plague.

United States.—A report of plague infection in Lake County, Oregon, and in Spokane County, Washington, appears on page 1138 of this issue of PUBLIC HEALTH REPORTS.

Public Health Reports

VOLUME 55 JUNE 28, 1940 NUMBER 26

IN THIS ISSUE

FEDERAL SECURITY AGENCY

UNITED STATES PUBLIC HEALTH SERVICE

THOMAS PARRAN, *Surgeon General*

DIVISION OF SANITARY REPORTS AND STATISTICS

CHARLES V. AKIN, *Assistant Surgeon General, Chief of Division*

The PUBLIC HEALTH REPORTS, first published in 1878 under authority of an act of Congress of April 29 of that year, is issued weekly by the United States Public Health Service through the Division of Sanitary Reports and Statistics, pursuant to the following authority of law: United States Code, title 42, sections 7, 30, 93; title 44, section 220.

It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

The PUBLIC HEALTH REPORTS is published primarily for distribution, in accordance with the law, to health officers, members of boards or departments of health, and other persons directly or indirectly engaged in public health work. Articles of special interest are issued as reprints or as supplements, in which forms they are made available for more economical and general distribution.

Requests for and communications regarding the PUBLIC HEALTH REPORTS, reprints, or supplements should be addressed to the Surgeon General, United States Public Health Service, Washington, D. C. Subscribers should remit direct to the Superintendent of Documents, Washington, D. C.

Librarians and others should preserve their copies for binding, as the Public Health Service is unable to supply the general demand for bound copies. Indexes will be supplied upon request.

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Public Health Reports

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PLAGUE IN THE UNITED STATES

By Brock C. Hampton, *Division of Sanitary Reports and Statistics, United States Public Health Service*

HUMAN CASES

The questions of when and how plague was introduced into the United States and whence it came will probably forever remain unanswered. There are certain known facts bearing upon the prevalence and epidemiology of the disease that may serve as a guide to speculation regarding these questions, but there is nothing more specific upon which to base the answers or build the structural evidence for sound logical deduction.

Plague had been quiescent for many years prior to 1894, when the latest and greatest pandemic in the Orient began its spread from Yunnan Province in China, first to Hong Kong, thence all over Asia within the next 2 years, then to Africa, western Europe, Hawaii, to South America in 1899, and to Australia either late in 1899 or early in 1900. It was known that plague infection was carried by rats and fleas on vessels and that human cases occurred on some of the vessels.

The first recorded appearance of plague in the United States, as well as on the North American continent, occurred in San Francisco, Calif., on March 6, 1900. On that date the body of a Chinese man who had died of the disease was discovered in the Chinese quarter of the city. A few days later, on March 11, the diagnosis of plague was proved, bacteriologically and by animal inoculation, by both the San Francisco Board of Health laboratory and officers of the United States Public Health Service.

In view of the fact that rat plague may exist in a city for some time without the development of the disease in human beings, as was found to be the case later in Seattle, Wash., and other cities, it is quite possible that the infection had been present among rats in San Francisco for many weeks or months prior to the discovery of the first human case.

The Annual Report of the Surgeon General of the Public Health Service for the fiscal year 1900 stated: "While during the year this

disease [bubonic plague] has made its appearance on vessels at several national and local quarantine stations in the United States, namely, Port Townsend, San Francisco, and New York, it was reported present in only one of these cities—San Francisco—and the time and method of its entrance have not as yet been determined." If the writer of that statement offered it somewhat apologetically, he need not have done so; for those facts have not yet been determined, and they are likely to remain forever locked in the historical vaults of the unknown, affording subjects for epidemiological theorization.

The account of the first appearance of the disease in this country and the fight made against it by public health officials, Federal and local, is a dramatic episode in the history of public health in the United States that is preserved in official records and in the files of the San Francisco newspapers. The existence of plague in San Francisco was firmly denied for months by many intelligent and well-meaning but uninformed persons—some of them doctors and health officials—as well as by others whose action was probably based on commercial interests; and the work of controlling the disease was hindered by the strong opposition interposed by newspapers, public officials, influential private citizens, and even the courts. It was only after a report had been made in 1901 by a special commission of impartial experts, appointed by the Surgeon General of the United States Public Health Service, that the matter was finally settled. The existence of human plague in San Francisco was not further vigorously denied, and the work of control was allowed to proceed unimpeded.

Human cases of plague continued to appear in San Francisco, and 121 cases with 113 deaths, principally in Chinese and Japanese and confined to the Chinese quarter of the city, had been reported up to February 1904, in which month the last case in this first outbreak was recorded. The work of cleaning up the infected area in Chinatown and getting rid of the rats terminated the epidemic and brought down the curtain on the first and most dramatic act in the history of plague in the United States. It provided an intermission, but did not end the play.

In May of 1907, a year after the earthquake and fire, plague was again discovered in San Francisco. A sailor taken to the Public Health Service Marine Hospital from a tug in the bay was found to be suffering from the disease, but he died in the hospital before any personal history could be obtained, and the tug was later lost at sea. On August 12, 1907, the second case of the second outbreak appeared, which was followed by 13 other cases before the end of the month. The first experience with plague was still fresh in the minds of the people, and so the efforts devoted to suppressing this second outbreak received the unanimous support of all interests and the epidemic was abated within a little more than a year; but during that period there

were reported 159 cases with 77 deaths. This time the cases were not confined to the Chinese quarter but were scattered throughout the city. The last case in this series in San Francisco occurred on June 30, 1908.

At about the time of this second outbreak, plague cases also occurred in localities adjacent to San Francisco. In 1907, 12 cases were reported in Oakland, 1 case in Berkeley, and 3 cases in Contra Costa County; and in 1908, 1 case was reported in Oakland, 2 cases in Contra Costa County, and 1 case in Los Angeles. In the latter year, plague was demonstrated in ground squirrels in Contra Costa County, the first proof that the infection had spread to these wild rodents in California.

During October 1907, human plague made its first appearance in Seattle, Wash. In 3 fatal cases the disease was proved bacteriologically, although an officer of the Public Health Service reported later that there were 7 cases and 7 deaths during this outbreak. According to the records, however, only 3 cases were positively diagnosed as plague. The source of the infection in Seattle is not known. It is possible that it came from San Francisco, as the port of Seattle was protected from Oriental and Hawaiian infection by quarantine restrictions. On the other hand, it may have been introduced direct from the Orient, as it has been pointed out that quarantine did not prevent the introduction of the disease into San Francisco in 1900, and cargoes of vessels arriving in Seattle from the Orient were generally more rat-attractive than those from San Francisco. Rat plague persisted in Seattle for 10 years subsequent to 1907, without the development of a human case, so far as known.

During the period 1908–1914, plague appeared in other localities in California, with a total of 22 human cases and 10 deaths occurring in San Francisco (city and county) and 8 other counties. Of these cases, 5 occurred in San Francisco, 3 in Oakland, 6 in Contra Costa County, just across the bay from San Francisco, and 1 case was reported in Los Angeles. During this period the area of human infection had extended into rural sections of the State as far south and east as San Benito and San Joaquin Counties, and the infection was found in rodents (rats and ground squirrels) during this period in many other counties of the State. Infected rats were found also in Seattle, Wash., during these years and in New Orleans, La., in 1912 and 1914.

The next outbreak of human plague in the United States occurred in New Orleans in 1914, with 30 cases and 10 deaths reported from June 21 to September 8. The first case occurred in a native of Sweden, who had resided in the city only since June 16. A history of previous residence was not obtained. Infected rats had been found in the city as early as 1912. Intensive plague-suppressive measures were instituted immediately on the appearance of human cases and the

plague-infection index in rats dropped rapidly in the following years. An additional mild case of plague occurred in the city in 1915, but no further case appeared until 1919–20, when another outbreak occurred with 22 cases and 8 deaths. No further cases have been reported in that city to date.

During the short period August 15–September 11, 1919, 13 cases of rapidly fatal pneumonic plague occurred in Oakland, Calif., the first outbreak of this type of the disease reported in the United States, although pneumonic cases had been reported in the first San Francisco epidemic. On the basis of bacteriological evidence, history of contacts, and clinical data all cases were attributed to plague. The first case in this Oakland epidemic appeared in a man who had been squirrel hunting on August 11 and 13 and became ill on August 15.

In 1920, human cases of plague appeared in Pensacola, Fla., and Galveston and Beaumont, Tex.

The only recorded appearance of plague in Pensacola, Fla., occurred during the period May 31–August 31, 1920. On June 11, the Public Health Service quarantine officer reported a suspected case of the disease. A careful history of the patient revealed that he had not been out of Pensacola nor on board a ship during the preceding 6 months, and as other cases made their appearance it was evident that the infection had been contracted locally. Also, a review of the city death records and subsequent investigation revealed that a fatal case of plague had occurred in the city on May 31. During the following 3 months, 10 cases with 3 deaths were reported.

In the same year, from June 16 to November 14, 18 cases of plague with 12 deaths occurred in Galveston, Tex. Plague eradicative measures were adopted, and no instance of rodent infection was found after May 29, 1922, when the last plague-infected rat was trapped in Galveston. To date, no further human cases have been reported there.

About the same time, from June 19 to August 23, 1920, 14 cases of plague with 6 deaths were reported in Beaumont, Tex. Intensive plague-suppressive measures were instituted, and the infection in rodents was soon brought under control. No further case of plague has appeared in Beaumont. In the same year, 1 fatal case occurred in Port Arthur, Tex., the only case that has been reported there, and another in Alameda County, Calif.

In 1921, New Orleans reported 3 cases with 3 deaths, and San Benito County, Calif., 3 cases with 1 death. In 1922, 1 case each, with no death, was reported in Elmhurst (Oakland) and Santa Cruz, Calif.; and in 1923, 1 case was reported in San Francisco.

The next outbreak of plague was that which occurred in Los Angeles, Calif., in 1924–25. During the period November 1, 1924–January 5, 1925, 41 cases with 34 deaths were recorded in that city, 33 cases of the pneumonic type, with 31 deaths, and 8 cases of the bubonic form

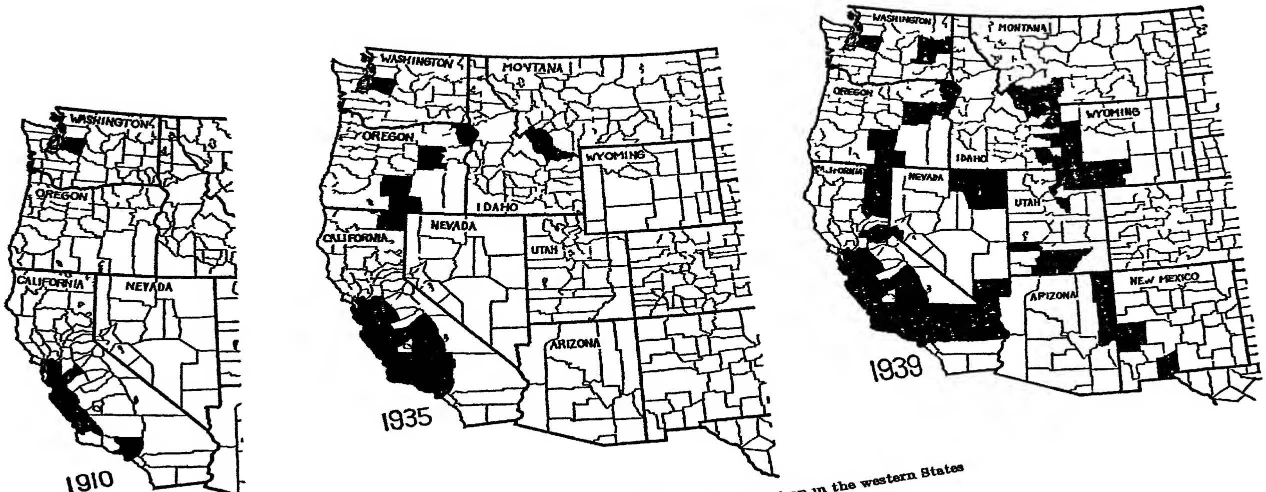

FIGURE 1.—Extension of known areas of plague infection in the western States

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FIGURE 1.—Extension of known areas of plague infection in the western States

with 3 deaths. Two sources of infection were considered: (*a*) The introduction of the disease from foreign ports through San Pedro (Los Angeles harbor) and (*b*) the transmission of the infection from ground squirrels to rats and thence to human beings. As intensive trapping operations in San Pedro disclosed no plague-infected rats there, greater weight was given the other possible source. Rats were found to be numerous in Los Angeles, infected ground squirrels were discovered there, and contact between the two species existed in many parts of the city. Furthermore, during the year there had been a virulent outbreak of plague in ground squirrels in San Luis Obispo County to the north of Los Angeles. Additional significance was given to this source by the type of the disease in man. The "marmot type" was suggested by the preponderance of lung involvement in the human cases; and the guinea pigs inoculated for confirmation also showed a predominance of lung lesions.

TABLE 1.—*Cases of human plague in the United States* [1]

Year	California		Washington		Louisiana		Florida		Texas		Oregon		Utah		Nevada		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
1900	22	22	----	----	----	----	----	----	----	----	----	----	----	----	----	----	22	22
1901	30	26	----	----	----	----	----	----	----	----	----	----	----	----	----	----	30	26
1902	41	41	----	----	----	----	----	----	----	----	----	----	----	----	----	----	41	41
1903	17	17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	17	17
1904	10	8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	10	8
1907	178	87	3	3	----	----	----	----	----	----	----	----	----	----	----	----	181	90
1908	8	5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	9	5
1909	3	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	3	1
1910	3	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	3	1
1911	4	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	4	1
1913	2	2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2	2
1914	1	0	----	----	30	10	----	----	----	----	----	----	----	----	----	----	31	10
1915	1	1	----	----	1	0	----	----	----	----	----	----	----	----	----	----	2	1
1919	13	13	----	----	15	5	----	----	----	----	----	----	----	----	----	----	28	18
1920	1	1	----	----	7	3	10	4	33	19	----	----	----	----	----	----	51	27
1921	3	1	----	----	3	3	----	----	----	----	----	----	----	----	----	----	6	4
1922	2	0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2	0
1923	1	0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	0
1924	41	34	----	----	----	----	----	----	----	----	----	----	----	----	----	----	41	34
1925	1	0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	0
1927	1	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	1
1928	3	2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	3	2
1933	1	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1	1
1934	1	0	----	----	----	----	----	----	----	----	1	1	----	----	----	----	2	1
1936	3	0	----	----	----	----	----	----	----	----	----	----	1	0	----	----	4	0
1937	1	1	----	----	----	----	----	----	----	----	----	----	----	----	1	0	2	1
1938	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0	0
1939	----	----	----	----	----	----	----	----	----	----	----	----	1	0	----	----	1	0
Total	392	265	3	3	56	21	10	4	33	19	1	1	2	0	1	0	499	314

[1] The annual figures for California for the years 1900–1908 were secured from various sources, some of which overlapped and required adjustment; therefore they may not agree with previously published figures. It is believed, however, that they are as nearly accurate as possible. Owing to conditions in the Chinese quarter of San Francisco, it is not to be expected that the records of cases or deaths in the first outbreak are complete, and probably some cases, in Chinese at least, were not recorded in the second epidemic in 1907.
The last reported human case to Jan. 1, 1940, occurred in Millard County, Utah, December 4, 1939.

Since 1924 and through 1939 only 15 cases of plague, with 6 deaths, have been reported in the United States, of which all but 4 cases and 1 death occurred in California. Two cases have been reported during

that period in Utah (1936, 1939), 1 case has been reported in Nevada (1937), and 1 case with 1 death was reported in Oregon (1934). The cases in California were reported in 8 counties, namely, Los Angeles (1925, 1933), Contra Costa (1927), Santa Cruz (1928), Monterey (1928, 1936), Santa Barbara (1928), Tulare (1934), Sonoma (1936), Placer (1936), and Fresno (1937).

From the time of the first appearance of plague in the United States in 1900 to January 1, 1940, there have been recorded 499 cases with 314 deaths. These figures may not agree with those presented elsewhere, as they have been compiled from various sources; and it may be reasonable to assume that, because of conditions existing in the Chinese quarter of San Francisco during the first plague epidemic in that city, and other difficulties which hampered the work of investigation and control, a complete record of cases in Chinese was not secured. Human cases of the disease in the United States have been reported in 8 States, in chronological order of first appearance as follows: California, 1900; Washington, 1907; Louisiana, 1914; Florida, 1920; Texas, 1920; Oregon, 1934; Utah, 1936; Nevada, 1937. The last human case of plague in the United States, up to January 1, 1940, was reported in Millard County, Utah, on December 4, 1939.

PLAGUE INFECTION IN WILD RODENTS, RODENT PARASITES, AND RABBITS

With only 8 cases of human plague reported in the United States during the 10-year period 1930–1939, the disease in human beings in this country may be thought to have become merely a matter of academic interest; but when the situation is viewed in the light of the expanding areas in which plague-infected wild rodents and insect parasites have been found in recent years, the disease assumes significant public health importance and becomes a problem fraught with potential danger. Within 10 years after plague first appeared in San Francisco, the infection was proved to exist in the ground squirrels in 9 California counties (not including San Francisco city and county), extending as far east as Stanislaus County and as far south as Los Angeles County, over 400 miles from San Francisco; and up to January 1, 1940, the infection has been found in wild rodents or their parasites in States as far north as Washington and Montana and as far east and south as New Mexico.

Plague-infected rats were found in San Francisco during the first plague epidemic, and systematic efforts were made by the local health authorities, in cooperation with the Public Health Service, to destroy them, to eliminate rat harborage, and to ratproof old buildings, especially in the Chinese quarter. Notwithstanding these plague-preventive measures, the infection probably continued in these rodents in San Francisco and increased after the relaxation of sup-

pressive measures to bring about a new human epidemic in 1907, following the earthquake and fire, which provided more favorable conditions of rodent and flea ecology.

The first demonstration of plague infection in ground squirrels in the United States was made in California in 1908, in Contra Costa County, across the bay from, and to the east of San Francisco, and in Los Angeles County. In Los Angeles, the infection was found that year in a ground squirrel which had bitten a boy who later developed plague. In 1909 and 1910, infected ground squirrels were found in seven other counties in California, in 1911 in three additional counties, in 1916 in San Mateo County, the north of which borders San Francisco (city and county), in 1917 in San Francisco, in 1925 in Oakland, and in 1928 in Ventura County.

In 1934 epizootics of plague were reported in ground squirrels in the Sierra Nevada Mountain areas of eastern California, in Kern and Tulare Counties, and in Modoc County at the extreme northwest corner of the State, bordering on Oregon; and in that year a fatal human case was reported in Lake County, Oreg., which is bordered by Modoc County, California, on the south.

Since 1900, field investigations of plague and plague-suppressive measures have been conducted continuously, though with varying degrees of intensity, in California by the State and local health authorities in cooperation with the United States Public Health Service, and since 1934 extensive field investigations have been conducted by the United States Public Health Service in cooperation with the health departments of five States. These studies have resulted in the discovery of wild-rodent plague in nine of the far western States, in addition to California, as follows: In Oregon and Montana in 1935; in Utah, Idaho, and Nevada in 1936; and in Washington State, Wyoming, New Mexico, and Arizona in 1938. In May 1939 plague infection was proved in tissue from a kangaroo rat trapped on April 15 about 10 miles west of Las Cruces, Dona Ana County, N. Mex. It is believed that this is the farthest east and south that plague has been demonstrated in wild rodents in the United States, and the first instance of the proof of plague among kangaroo rats in this country.

On June 19, 1939, Surgeon C. R. Eskey reported plague infection proved in the tissue of a cottontail rabbit, taken May 27, in Lincoln County, Wash. This was believed by Doctor Eskey to be the first demonstration of plague in a rabbit in nature.

In 1936 the method of parasite inoculation of experimental animals was adopted by the United States Public Health Service investigators as a routine procedure for locating plague infection among wild rodents. In that year this method was first used by Surgeon C. R. Eskey in demonstrating infection in fleas collected from ground

squirrels in northern Nevada. Since then, and up to the middle of 1939, over 4,000 inoculation tests had been made of more than 200,000 parasites, principally fleas, collected from wild rodents.

To January 1, 1940, plague infection has been demonstrated in 14 species of ground squirrels, in red squirrels, tree squirrels, and flying squirrels, in wood rats, kangaroo rats, field mice, prairie dogs, chipmunks, marmots, and a cottontail rabbit in western United States, and in fleas, lice, and ticks from wild rodents. By inoculation tests of parasites, plague infection has been proved in approximately 100 pooled inoculations of fleas, 6 inoculations of lice, and 2 inoculations of ticks. In many instances flea infection was demonstrated while lice and ticks from the same groups of animal hosts were not found infected. On the other hand, one inoculation of ticks and one of lice produced plague infection in test animals when the fleas from the same hosts were not found infectious.

From the available evidence and the records it appears that plague infection has spread from the rats in San Francisco first to the ground squirrels and then to other wild rodents in western United States. It may also have spread from the rats in Seattle, Wash.; but in view of the early discovery of the infection in the ground squirrels of the San Francisco Bay region, the gradual extension thence north, east, and south, the large numbers of such native rodents in California, and the favorable natural opportunities for them to maintain a reservoir of infection and to extend it, among their own species and to other species, it would appear that this has been the important source of the extension of the disease north, east, and south to the other western States. It is possible that scavenger birds have played some part in spreading the infection, as fleas and ticks have been found in the nests of the burrowing owl, which is a constant companion of the ground squirrel and is frequently a joint tenant in the burrows of this rodent. Casts from such predatory birds which have been fed plague-infected guinea pig tissue have been shown to be consistently infectious, and avian red cells have been found in the intestinal contents of ticks from the burrows and nests of the western burrowing owl. However spread, it can be said that wild rodent plague has apparently been gradually extending eastward from the Pacific Coast.

Whether or not the wild rodents inhabiting the States east of the Rocky Mountains will maintain the infection and disseminate it farther east can only be surmised. The present known foci in this region are fortunately removed from thickly populated metropolitan areas, and the density of the rodent population and probably the index of infection are low. However, as the records show, wild rodent plague may spread unnoticed over great areas unless intensive investigative measures are taken to detect its presence, and it may continue to spread unless suppressive measures are adopted to prevent

it. It is evident that farther spread of the infection eastward, through a rodent and human population of insufficient density to give rise to explosive epidemics, will eventually bring the disease within striking distance of the rat and human populations of large cities. Then, through a reversal of the original sequence of spread, the disease may become epidemic in any city near the approaching danger zone which has a sufficiently high population of rats and a sufficiently high flea index to provide favorable conditions for human infection.

In view of the relatively small numbers of cases of plague and deaths from the disease in the United States during the past 40 years, it might appear to some persons that too much prominence has been accorded it and too much effort devoted to it as a public health problem in this country; but it still holds our interest, because it scaled the barrier of quarantine, because of its persistence and gradual biological and geographic spread, and because of the difficulty in eradicating it entirely in vast areas of low biological density. In rural areas where the disease is maintained in wild rodents, it occasionally takes a human life, and it remains like a smouldering fire, ready to burst into flame at any place where the smoke of infection appears and adequate protective measures have not been applied. With full knowledge of how to prevent and control the disease, however, plague in epidemic form should never again be permitted to occur in any locality in the United States.

TABLE 2.—*Chronological record of plague infection[1] in rodents, rodent parasites, and rabbits in counties of the western States as reported to the United States Public Health Service*

Year	State and County or City	Infection found in—
1902	California: San Francisco	Rats.
1903	do	Do
1904	do	Do.
1907	Washington: Seattle	Do.
	California:	
	Oakland	Do.
	San Francisco	Do.
1908	California:	
	Contra Costa County	Ground squirrels and rats.
	Los Angeles	Ground squirrels.
	Oakland	Rats.
	San Francisco	Do.
	Washington: Seattle	Do.
1909	California:	
	Alameda County	Do.[2]
	Contra Costa County	Ground squirrels.
	Santa Clara County	Do.
	Santa Cruz County	Do.
1910	California:	
	Alameda County	Do.
	Contra Costa County	Do.
	Monterey County	Do.
	San Benito County	Do.
	Santa Clara County	Do.
	Santa Cruz County	Do.
	San Luis Obispo County	Do.
	Stanislaus County	Do.
	Washington: Seattle	Rats.

[1] As the method of mass or pooled inoculation was used to determine plague infection in most instances, individual infection in each species of animal or parasite was not proved in every instance here recorded, although it has been demonstrated separately in each species.
[2] Plague infection found in a wood rat on Oct. 17, 1909.

TABLE 2.—*Chronological record of plague infection in rodents, rodent parasites, and rabbits in counties of the western States as reported to the United States Public Health Service*—Continued

Year	State and County or City	Infection found in—
1911	California:	
	Alameda County	Ground squirrels.
	Contra Costa County	Do.
	Fresno County	Do.
	Merced County	Do.
	Monterey County	Do.
	San Benito County	Do.
	Santa Barbara County	Do.
	San Joaquin County	Do.
	Stanislaus County	Do.
	Washington: Seattle	Rats.
1912	California:	
	Alameda County	Wood rat and ground squirrels.
	Contra Costa County	Ground squirrels.
	Louisiana: New Orleans	Rats.
1913	California:	
	Alameda County	Ground squirrels.
	Contra Costa County	Do.
	San Benito County	Do.
	Santa Clara County	Do.
	Washington: Seattle	Rats.
1914	California:	
	Alameda County	Ground squirrels.
	Contra Costa County	Do.
	Monterey County	Do.
	San Benito County	Do.
	Louisiana: New Orleans	Rats.
	Washington: Seattle	Do.
1915	California:	
	Alameda County	Ground squirrels.
	Contra Costa County	Do.
	San Benito County	Do.
	Louisiana: New Orleans	Rats.
	Washington: Seattle	Do.
1916	California:	
	Alameda County	Ground squirrels.
	Contra Costa County	Do.
	Merced County	Do.
	Monterey County	Do.
	San Benito County	Do.
	San Mateo County	Do.
	Santa Clara County	Do.
	Santa Cruz County	Do.
	Louisiana:	
	New Orleans	Rats.
	Jefferson Parish	Do.
	St. Bernard Parish	Do.
	Washington: Seattle	Do.
1917	California:	
	Alameda County	Ground squirrels.
	San Benito County	Do.
	San Francisco	Do.
	San Mateo County	Do.
	Santa Cruz County	Do.
	Louisiana:	
	Jefferson Parish	Rats.
	New Orleans	Do.
	Washington: Seattle	Do.
1918	California:	
	Alameda County	Ground squirrels.
	Contra Costa County	Do.
	San Mateo County	Do.
1919	California:	
	Alameda County	Do.
	Contra Costa County	Do.
	San Mateo County	Do.
1920	California:	
	Alameda County	Do.
	Contra Costa County	Do.
	Merced County	Do.
	Monterey County	Do.
	San Benito County	Do.
	San Joaquin County	Do.
	Santa Clara County	Do.
	Santa Cruz County	Do.
	Stanislaus County	Do.
	Florida: Pensacola	Rats.
	Louisiana: New Orleans	Do.
	Texas:	
	Beaumont	Do.
	Galveston	Do.
	Port Arthur	Do.

TABLE 2.—*Chronological record of plague infection in rodents, rodent parasites, and rabbits in counties of the western States as reported to the United States Public Health Service*—Continued

Year	State and County or City	Infection found in—
1921	California: San Benito County	Ground squirrels.
	Florida: Pensacola	Rats.
	Louisiana: New Orleans	Do.
	Texas: Galveston	Do.
1922	California:	
	Alameda County	Ground squirrels.
	Santa Cruz County	Do.
	Texas: Galveston	Rats.
1923	California: Contra Costa County	Ground squirrels.
1924	California:	
	Los Angeles	Rats.
	Oakland	Do.
	San Benito County	Ground squirrels.
	San Luis Obispo County	Do.
1925	California:	
	Los Angeles	Rats.
	Oakland	Ground squirrels.
	Louisiana: New Orleans	Rats.
1926	California:	
	Los Angeles	Do.
	San Benito County	Ground squirrels.
1927	California:	
	Contra Costa County	Do.
	Los Angeles	Rats.
1928	California:	
	Alameda County	Ground squirrels.
	Contra Costa County	Do.
	----do	Rats.
	Los Angeles	Ground squirrels.
	Monterey County	Do.
	San Benito County	Do.
	San Luis Obispo County	Do.
	Santa Cruz County	Do.
	Ventura County	Do.
1929	California:	
	Monterey County	Rats.
	----do	Ground squirrels.
	San Benito County	Do.
	San Luis Obispo County	Do.
	Santa Barbara County	Do.
	Santa Clara County	Do.
	----do	Rat.
1931	California:	
	Monterey County	Ground squirrels.
	San Benito County	Do.
1932	California:	
	Los Angeles	Rat.
	San Benito County	Ground squirrel.
1933	California:	
	San Benito County	Do.
	Santa Clara County	Do.
1934	California:	
	Kern County	Ground squirrels.
	Modoc County	Ground squirrels and rat.
	Tulare County	Ground squirrels.
1935	California:	
	Lassen County	Do.
	Modoc County	Field mouse.
	----do	Ground squirrels.
	San Luis Obispo County	Wood rat.
	----do	Ground squirrels.
	Montana: Beaverhead County	Ground squirrel.
	Oregon:	
	Grant County	Do.
	Lake County	Do.
	Wallowa County	Do.
1936	California:	
	Eldorado County	Chipmunk.
	Lassen County	Ground squirrels.
	Modoc County	Fleas from ground squirrels.
	Monterey County	Do.
	San Bernardino County	Do.
	Santa Cruz County	Ground squirrels and fleas from ground squirrels.
	Ventura County	Do.
	Idaho: Bonneville County	Do.
	Montana: Beaverhead County	Marmots and fleas and lice from marmots.
	Nevada: Elko County	Fleas from ground squirrels.
	Utah:	
	Beaver County	Ground squirrels and marmot.
	Garfield County	Prairie dogs and fleas from prairie dogs.

TABLE 2.—*Chronological record of plague infection in rodents, rodent parasites, and rabbits in counties of the western States as reported to the United States Public Health Service*—Continued

Year	State and County or City	Infection found in—
1937	California:	
	Eldorado County	Fleas from ground squirrels.
	Fresno County	Ground squirrels, flying squirrels, chipmunks, and mice, and fleas from ground squirrels, red squirrels, and chipmunks.
	Placer County	Pooled tissue from ground squirrels, chickaree squirrel, chipmunks, wood rats, and alexandrinus rats, and fleas from ground squirrels and chipmunks.
	San Bernardino County	Ground squirrels and fleas from ground squirrels, mice, wood rats, and chipmunks.
	San Mateo County	Fleas, lice, and ticks from ground squirrels.[3]
	Idaho: Bannock County	Ground squirrels and fleas and tick from ground squirrels.
	Montana:	
	Beaverhead County	Ground squirrel.
	Madison County	Do.
	Nevada:	
	Douglas County	Fleas from chipmunks.
	Ormsby County	Fleas from chipmunks and fleas and lice from ground squirrels.
	Oregon:	
	Grant County	Ground squirrel.
	Lake County	Fleas from ground squirrels.
	Wallowa County	Ground squirrels and fleas from ground squirrels.
	Utah:	
	Morgan County	Fleas from ground squirrels.
	Wasatch County	Ground squirrel.
	Washington: Adams County	Fleas and lice from ground squirrels.[4]
1938	Arizona: Apache County	Fleas from prairie dogs.
	California:	
	Eldorado County	Ground squirrels and fleas from ground squirrels.
	Fresno County	Do.
	Plumas County	Ground squirrels.
	San Benito County	Ground squirrels and fleas from ground squirrels.
	San Bernardino County	Do.
	Santa Clara County	Fleas from ground squirrels.
	Santa Cruz County	Ground squirrels and fleas from ground squirrels (some collected from ground squirrel burrows).
	Idaho:	
	Bannock County	Ground squirrels and fleas and lice from ground squirrels and marmots.
	Bear Lake County	Ground squirrels and fleas from ground squirrels.
	Montana:	
	Beaverhead County	Ground squirrels and fleas from ground squirrels.
	Gallatin County	Fleas from ground squirrels.
	Nevada: Clark County	Fleas from desert wood rats.
	New Mexico: Catron County	Prairie dogs and fleas from prairie dogs, field mice, and ground squirrels.[5]
	Oregon:	
	Baker County	Ground squirrels and fleas from ground squirrels.
	Grant County	Ground squirrels and fleas, louse, and tick from ground squirrels.
	Utah:	
	Kane County	Fleas from desert wood rats.
	Rich County	Fleas from ground squirrels.
	Wasatch County	Ground squirrel.
	Washington:	
	Adams County	Ground squirrels and fleas and lice from ground squirrels.
	Lincoln County	Ground squirrels.

[3] Collected in September 1936 and stored in icebox until July 1937.
[4] It is believed that this was the first positive evidence that plague existed in the wild rodents of Washington State and that the locality in which the infected fleas and lice were collected is the most northern point in the United States in which wild rodent plague has been found.
[5] Infection proved in prairie dogs and fleas from prairie dogs on August 20, 1938. This is believed to be the first evidence of plague in wild rodents in New Mexico.

TABLE 2.—*Chronological record of plague infection in rodents, rodent parasites, and rabbits in counties of the western States as reported to the United States Public Health Service*—Continued

Year	State and County or City	Infection found in—
1938	Wyoming:	
	Lincoln County	Ground squirrels and fleas, lice, and ticks from ground squirrels.
	Sublette County	Fleas and lice from ground squirrels.
	Uinta County	Ground squirrels [6] and fleas from ground squirrels and prairie dogs.
1939 [7]	California:	
	Contra Costa County	Fleas from ground squirrels.
	Eldorado County	Do.
	San Benito County	Ground squirrel.
	Ventura County	Ground squirrels and fleas from ground squirrels.
	Idaho: Fremont County	Fleas from ground squirrels.
	Montana: Beaverhead County	Ground squirrel and fleas from ground squirrels.
	Nevada: Clark County	Fleas from desert wood rats.
	New Mexico: Dona Ana County	Kangaroo rat.[8]
	Oregon:	
	Grant County	Fleas from ground squirrels.
	Wallowa County	Ground squirrels and fleas from ground squirrels.
	Washington:	
	Adams County	Fleas and lice from ground squirrels.
	Lincoln County	Cottontail rabbit [9] and fleas from ground squirrels.
	Wyoming: Sweetwater County	Fleas from prairie dogs.

[6] On July 8, 1938, plague infection was proved in a ground squirrel and a pool of 19 fleas from ground squirrels taken in Uinta County. This is believed to be the first positive demonstration of wild rodent plague in this State.
[7] In December 1939, a human case of plague was reported in Millard County, Utah. The patient was engaged in trapping and skinning bobcats (wild cats) and coyotes, and occasionally handled rabbits.
[8] The farthest south and east that plague infection had been demonstrated in wild rodents in the United States up to 1940.
[9] Believed to be the first demonstration of plague infection in a rabbit.

The following is a list of wild rodents and rabbits of the western States which have been found plague-infected or are known to suffer from spontaneous plague:[1]

Order RODENTIA. Family SCIURIDAE

Genus *Citellus*. Ground squirrel.

1. *Citellus armatus.* Uinta ground squirrel.
2. *Citellus beecheyi beecheyi.* California ground squirrel.
3. *Citellus beecheyi fisheri.* Fisher's ground squirrel.
4. *Citellus beldingi oregonus.* Oregon ground squirrel.
5. *Citellus columbianus columbianus.* Columbian ground squirrel.
6. *Citellus columbianus ruficaudus.* Blue Mountain ground squirrel.
7. *Citellus lateralis chrysodeirus.* Golden mantled ground squirrel.
8. *Citellus richardsonii elegans.* Wyoming ground squirrel.
9. *Citellus richardsonii nevadensus.* Nevada ground squirrel.
10. *Citellus richardsonii richardsonii.* Richardson's ground squirrel.[2]
11. *Citellus variegatus grammurus.* Say's rock squirrel.
12. *Citellus variegatus utah.* Utah rock squirrel.
13. *Citellus washingtoni loringi.* Loring's ground squirrel.
14. *Citellus washingtoni washingtoni.* Washington ground squirrel.[2]

[1] Furnished by Surgeon L. B. Byington, Plague Suppressive Measures Laboratory, San Francisco, Calif.
[2] Identification in question owing to change in nomenclature.

Genus *Tamiasciurus*. Red squirrel.

Tree squirrels

15. *Tamiasciurus douglasii albolimbatus*. California chickaree.[3]

Genus *Glaucomys*. Flying squirrel.

16. *Glaucomys sabrinis lascivus*. Sierra flying squirrel.[3]

Genus *Eutamias*. Western chipmunk.

17. *Eutamias quadrivittatus frater*. Tahoe chipmunk.

Genus *Cynomys*. Prairie dog.

18. *Cynomys gunnisoni zuniensis*. Zuni prairie dog.
19. *Cynomys leucurus*. White-tailed prairie dog.
20. *Cynomys parvidens*. Utah prairie dog.

Genus *Marmota*. Marmot.

21. *Marmota flaviventris engelhardti*. Engelhardt marmot.
22. *Marmota flaviventris nosophora*. Golden mantled marmot.

Family Cricetidae. Native rats and mice.

Genus *Neotoma*. Wood rat.

23. *Neotoma cinerea occidentalis*. Western bushy-tailed wood rat.[3]
24. *Neotoma fuscipes mohavensis*. Mohave Desert wood rat.[3]
25. *Neotoma lepida intermedia*. Rhoads wood rat.[3]
26. *Neotoma lepida lepida*. Desert wood rat.

Genus *Peromyscus*. White-footed mouse.

27. *Peromyscus truei gilberti*. Gilbert's white-footed mouse.[3]
28. *Peromyscus truei truei*. True white-footed mouse.

Family Heteromyidae. Pocket rats and pocket mice.

Genus *Dipodomys*. Pocket rat, kangaroo rat.

29. *Dipodomys ordii ordii*. Ord's kangaroo rat.

Order LAGOMORPHA. Hares, rabbits, and pikas.

Family Leporidae: Hares and rabbits.

30. *Sylvilagus nuttallii nuttallii*. Washington cottontail rabbit.

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CLOTHING FOR PROTECTION AGAINST OCCUPATIONAL SKIN IRRITANTS

By Louis Schwartz, *Medical Director*, Leon H. Warren, *Acting Assistant Surgeon*, and Frederick H. Goldman, *Associate Chemist, United States Public Health Service*

The wearing of protective clothing is one of the methods for the prevention of occupational dermatitis. Details as to designs and fabrics most suitable for such clothing are not found in medical literature. The present study is an attempt to find fabrics most satisfactory for protection against the various types of occupational skin irritants and to suggest such designs as will be most protective and practical.

Clothing made of fabrics permeable to liquids or gases offers protection only if frequently changed and cleaned, because if exposed for any length of time to the chemicals from which they are to protect the skin, they become saturated and are apt to act as a poultice of these irritants. For this reason fabrics impermeable to chemicals are to be preferred. Rubber and oilcloth have been used for this purpose, but they have many disadvantages. Rubber is heavy and workers are prejudiced against its use because it is well known that rubber increases the amount of perspiration and prevents its evaporation. Besides, rubber is attacked by many of the industrial solvents such as the petroleum solvents, carbon bisulfide, the chlorinated hydrocarbons, and so forth. The rubber compounds are also known to produce dermatitis. Oilcloth is usually heavy, rather unpliable, inflammable, and is attacked by even more substances than is rubber.

There are now obtainable on the market many synthetic resins which can be either laminated or calendered onto fabrics, making

them impermeable to fumes, dusts, and certain liquids. Some of these resins can also be plasticized so as to form films of sufficient strength and pliability to make suitable impermeable protective clothing.

Seventeen samples of impermeable fabrics and films were obtained and tested for their suitability as protective clothing. The tests consisted in exposing the materials to the action of (1) carbon tetrachloride, (2) ethylene dichloride, (3) ligroin, (4) mineral oil, (5) vegetable oil, (6) ethyl alcohol, (7) 20 percent commercial hydrochloric acid, and (8) 40 percent solution of potassium hydroxide.

It was first thought that these fabrics could be fitted into a glass funnel much like a piece of filter paper and the test solutions poured onto the fabric, the stem of the funnel being immersed in a solution of a test reagent. It was soon found, however, that many of the materials would not stand being folded into a funnel shape without cracking or breaking. While this fault of the material would render it unsuitable for clothing, nevertheless we desired to test the permeability of such materials to our test solutions. Therefore, an apparatus was devised in which these tests could be performed without damaging the material. The apparatus (fig. 1) consisted of two brass cylinders with flanges and gaskets, between which the piece of fabric to be tested could be inserted and then the cylinders could be tightly screwed together. The testing liquid was placed on the fabric in the upper cylinder and the lower cylinder was immersed in an indicator solution so that any of the liquid which might go through the fabric could be detected. The solution was allowed to stay on the fabric for 16 hours. All of the fabrics tested were impervious to mineral oil, vegetable oil, and alcohol. Only one of them was impervious to carbon tetrachloride and none to ethylene dichloride. All of the fabrics that were laminated or impregnated with films of the resins showed more permeability than did the films themselves. This can be accounted for by the fact that capillary seepage took place through particles of the nap of the fabric which were not sufficiently covered by the film of resin.

For the reasons previously stated, oilcloth was not desirable for this type of protective clothing; therefore, the two samples of oilcloth will not be considered. Moreover, the tests made with them showed that they were permeable to all the test solvents except mineral oil, vegetable oil, and alcohol.

The fabric laminated with cellophane, while impermeable to ligroin, mineral oil, alcohol, and vegetable oil, was not suitable for protective clothing because it cracked when folded and became permeable to anything through the cracks. In addition, it is highly inflammable.

The fabric impregnated with a plasticized resin consisting of vinyl

chloride and vinylidin chloride was permeable to all solvents with which it was tested. This was because of the nap which came through the thin coating of resin. Seven other fabrics laminated with various thicknesses of a plasticized[1] resin consisting of a copolymer of vinyl chloride and vinyl acetate were permeable to the same solvents. Three of these were also tested with alcohol and vegetable oil and found to be impermeable. The film of this copolymer, however, was impermeable to carbon tetrachloride, mineral oil, acid, alcohol, and vegetable oil. A sample of a film made of a plasticized polymer of vinyl chloride resisted the action of mineral oil, acid, alkali, alcohol, and vegetable oil, as did a sample of fabric coated with three layers of this material.

Table 1 shows the results of these tests, the plus sign (+) meaning that the fabric was permeable and the minus sign (—) indicating that it was not. It will be noted that fabrics 1 and 2 show the greatest resistance against these solvents, being permeable only to carbon tetrachloride and ethylene dichloride. These two materials consist of rubber chloride containing an antioxidant and differ from each other in that one of them is an unstretched film and the other is a lighter double stretched film.

TABLE 1.—*Result of exposing materials to solvents for 16 hours*

Material	Ligroin	20 percent HCl	40 percent KOH	Alcohol	Mineral oil	Vegetable oil	CCl_4	Ethylene dichloride
1. Pliofilm. Rubber hydrochloride 240 laminated clear. Antioxidant	—	—	—	—	—	—	+	+
2. Pliofilm. 150 double stretched clear	—	—	—	—	—	—	+	+
3. Vinylite. A copolymer of vinyl chloride and vinyl acetate	+	—	+	—	—	—	—	+
4. Koroseal. A polymer of vinyl chloride	+	—	—	—	—	—	+	+
5. Koroseal coated onto fabric	+	—	—	—	—	—	+	+
6. Fabric coated with a mixture of vinyl chloride and vinylidin chloride resin	+	(1)	+	(1)	(1)	(1)	+	(1)
7. Sample No. 3 of fabric calendered with a vinylite film	+	(1)	+	(1)	(1)	(1)	+	(1)
8. Sample No. 4 of the above resin	+	(1)	+	(1)	(1)	(1)	+	(1)
9. Sample No. 2 of the above resin	+	(1)	+	(1)	(1)	(1)	+	(1)
10. Sample No. 1 of the above resin	+	(1)	+	(1)	(1)	(1)	+	(1)
11. Synflex. Fabric coated with vinylite resin. 133A—heaviest coating	+	(1)	+	—	(1)	—	+	(1)
12. Synflex. 133B—lighter coating	+	(1)	+	—	(1)	—	+	(1)
13. Synflex. 133C—lightest coating	+	(1)	+	—	(1)	—	+	(1)
14. Fabrilite. 2 Green OR 0539 oilcloth	(1)	+	+	(1)	(1)	(1)	(1)	(1)
15. Standard oilcloth	(1)	—	+	(1)	(1)	(1)	(1)	(1)
16 Standard oiled green unfinished	(1)	+	+	(1)	(1)	(1)	(1)	(1)
17. 300 P. T. cellophane laminated on a closely woven white fabric	—	+	+	—	—	—	+	+

[1] Not tested.
+=permeable.
—=impermeable.

Both the tested films and fabrics coated with the synthetic resins give protection against mild acids, mild alkalies, alcohol, and oils,

[1] Plasticizers such as castor oil, glycol wax, dimethyl cellosolve phthalate, dimethyl cellosolve oleate, tricresyl phosphate, and dibutyl phthalate are used. In addition to this, some of the resins contain stabilizers and antioxidants.

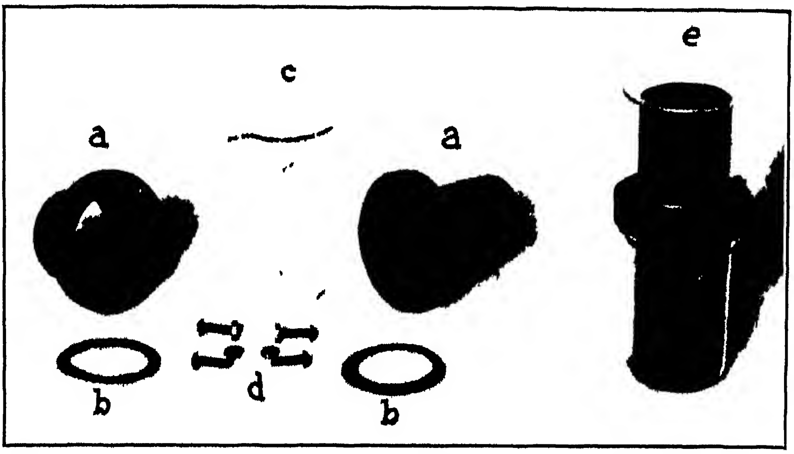

FIGURE 1. Apparatus for testing fabrics: (a) Sections of testing cylinder, (b) gaskets, (c) beaker of testing solution, (d) assembly bolts and nuts, (e) assembled cylinder.

FIGURE 2 —Protective hood, sleeves, gloves, and apron Note sleeves secured over gloves, neck protected by hood, and apron extending to neck.

and are impermeable to dust; therefore they can be used for protective clothing in such industries as fruit and vegetable canning, in resin molding where the exposure is to oils, and in other occupations where the skin hazards are maceration or only mild irritants and sensitizers.

All of these materials are light in weight, transparent, and although they increase and retain perspiration they do not give the cold, clammy feeling of rubber clothing and the workers are not prejudiced against their use. These materials not only prevent irritants from coming in contact with the skin, but also protect the clothing beneath them. They are not inflammable, can be easily washed with ordinary soap and water, but must not be pressed with a hot iron. With ordinary care they will last a number of months in rough occupations, or longer if not subjected to rough usage. Some of these resins will soon be available in the form of gloves, having pliability and elasticity comparable to rubber. Such gloves may be used in occupations where rubber is attacked by the chemicals used, or in cases where the worker is allergic to rubber or its compounds.

In many industries only the hands and the forearms need to be protected. In such cases rubber gloves can be worn under sleeves made from these materials. In other industries aprons and hoods may also be necessary to protect the front part of the body (fig. 2). In still other industries, for instance spray painting, it may be necessary to wear coveralls, gloves, and hoods.

SUGGESTED DESIGNS FOR PROTECTIVE CLOTHING

Gloves.—Gloves should fit fairly snug, should not be cumbersome, and should extend a sufficient distance beyond the wrist so that they fit under the sleeves.

Sleeves.—Sleeves should reach from the wrist to the armpit. They should be fastened at the wrists and at the upper ends. They should fit over the gloves and should be sufficiently roomy to allow for flexing of the elbows without sliding up and down the arm.

Aprons. Aprons should be full and should cover the front of the body from well below the knee to the neck. They should be fastened around the neck and waist.

Hoods.—Hoods should fit over the head and come down to the shoulders, protecting the collar line. They can be made with openings at the eyes, nostrils, and mouth. In occupations where it is necessary to protect against the inhalation of poisonous chemicals, the hood can be entirely closed, except for an opening at the mouth, the edges of which should be so constructed that a removable air filter can be fitted into it. At the top of such a hood there should be fitted a flap valve to allow the escape of expired air.

Coveralls.—Coveralls should fit snug at the neck and may have zipper fronts, or can be so constructed that the front is a continuous

The labor turn-over of employment is evidenced by the fact that the average length of membership during the 5 years was 38 months. Had the membership been continuous during the 60 months it would have resulted in a total of 480,360 months instead of the 300,955 months shown in this report.

The analysis which follows will be limited to white males and white females, since they represent 98.9 percent of the total months of membership. It will be noted that the data make available an unusually large proportion of membership among white females which permits a comparison by sex in some detail.

Type of sick benefit organization.—In the 4 mail order stores studied 1 provided sick benefits through a company operated sick benefit plan and 3 through an employees' mutual benefit society. In the first store membership in the sick benefit organization was automatic for all employees who had worked 6 months. The waiting period and the maximum benefit period varied with the length of service according to the following schedule: Employees with 5 or more years of continuous service were allowed full salary after a waiting period of 2 days for a maximum benefit period of 10 weeks, employees with 2 to 5 years of service had a waiting period of 7 days and a maximum benefit period of 8 weeks, while those employees with 6 months to 2 years of service had a waiting period of 7 days and a maximum benefit period of 3 weeks. Benefits were refused for disabilities connected with sunburn or results therefrom, nervousness where there was no organic trouble, contagious or infectious skin disorders, and for ailments present when the employee was first engaged.

In the other 3 mail order stores the waiting period was 3 days and the maximum benefit period 13 weeks. Membership was on a voluntary basis with eligibility after 30 days in 2 stores and after 90 days in the third store. In each store a member did not become eligible to receive sick benefits until a month after joining the association. There were several classes of membership in the sick benefit organizations, based on the salary received, which required different dues and offered different amounts of aid during disability.

In 3 stores membership ceased immediately at the termination of service with the company. One store, in the event of a temporary lay-off, allowed membership to continue as long as the employee's name remained on the pay roll. Benefits were refused in each of the 4 stores for disabilities connected with the improper use of stimulants or narcotics, unlawful acts, and maternity cases. Additional causes for refusal of benefits were listed in certain stores.

Standardization of waiting and maximum benefit periods.— The data for all 4 sick benefit organizations are presented according to certain standard conditions necessitated by the variations in the length of the waiting and maximum benefit periods. The method used has been described in preceding papers of this series (*4, 5*). In the present study only one company, and then limited to employees with 6 months to 5 years of service, required a waiting period as long as the standard, namely, 7 days. The others required a shorter period but the cases lasting 7 days and less were excluded when the data were brought into conformity with standard conditions; the maximum benefit periods were either equal to or less than the standard of 13 weeks, necessitating in the latter instance the extension to 13 weeks of cases reaching maximum benefit.

Occupational classification.—The occupational groups in mail order stores have a somewhat different distribution than that in many industries. There is one group, office workers, representing a large

proportion of all male and female employees. Contrasted with this group, which is subject to the same general environmental conditions, although diversified with respect to specific tasks, are 5 other groups among males and 2 other groups among females. The very great variety of specific occupations included within these broad groups is shown in table 1. It will be observed that, although certain general rates are given for each of the broad occupational groups, the detailed analysis is confined to office workers as contrasted with workers in all other occupations. Little reliance can be placed on comparison by sex of all other occupations, since very different environmental conditions and economic status are represented in the male as compared with the female group.

TABLE 1.—*Specific occupations comprising each occupational group, mail order stores*

Occupational group	Specific occupation
	White males
Office workers	Accountants, addressers, adjusters, auditors, billers, bookkeepers, cashiers, complaint clerks, copy readers, credit managers, dispatchers, estimators, export clerks, filing clerks, index clerks, information clerks, inspectors, invoice clerks, mail clerks, office machine operators, order clerks, pay roll clerks, pre-adjusters, pricers, purchasing agents, rate clerks, receiving clerks, refund clerks, shipping clerks, sorters, statisticians, stock clerks, storekeepers, superintendents, tag writers, timekeepers, traffic managers, treasurers, weighers.
Foremen	Department heads, division foremen, floormen, night foremen, supervisors, trainers.
Stock handlers, truckers, wrappers, and packers.	Bundlers, car unloaders, chute men, labelers, mail loaders, packers, sealers, supply men, ticket sorters, truckers, warehousemen, wrappers.
Repairmen and carpenters.	Box makers, cabinetmakers, carpenters, craters, electrical mechanics, framers, furniture repairmen, gunsmiths, locksmiths, mechanics, merchandise repairmen, nailers, radio mechanics, sawyers, shoemakers, staplers.
Laborers, watchmen, and janitors.	Car cleaners, clean-up laborers, janitors, pit sweepers, police, porters, street cleaners, tunnel men, utility men, watchmen, yardmen.
All others	Barbers, buyers, chauffeurs, coal heavers, draftsmen, electricians, elevator operators, engineers, engravers, filling-station attendants, firemen, machinists, millwrights, oilers, painters, paint makers, plumbers, pressers, salesmen, sign painters, steamfitters, tailors, truck drivers, waiters, wallpaper printers, window trimmers.
	White females
Office workers	Addressers, adjusters, billers, bookkeepers, cashiers, complaint clerks, copy readers, dispatchers, estimators, export clerks, filing clerks, index clerks, information clerks, inspectors, invoice clerks, mail clerks, office machine operators, order clerks, pay roll clerks, preadjusters, pricers, rate clerks, receiving clerks, refund clerks, secretaries, shipping clerks, sorters, statisticians, stenographers, stock clerks, tag writers, timekeepers, typists, weighers.
Stock handlers, wrappers, and packers.	Bundlers, labelers, packers, sealers, ticket sorters, wrappers.
All others	Buyers, cooks, dishwashers, elevator operators, forcladies, janitresses, laundresses, maids, matrons, nurses, saleswomen, seamstresses, shade sewers, telephone operators, waitresses, wallpaper trimmers, washroom attendants.

ANALYSIS OF THE DATA

Age distribution by occupational group.—A comparison of the age distribution of gainful workers in wholesale and retail trade, except automobile agencies and filling stations, as given in the United States

census of 1930 (*9*, pp. 570–571), with the age distribution of the membership in the present study is shown in the following table:

Age in years	Percentage distribution			
	Male		Female	
	Wholesale and retail trade, U. S. census 1930	Mail order stores	Wholesale and retail trade, U. S. census 1930	Mail order stores
Total, known ages	100.0	100.0	100.0	100.0
Under 25	20.2	20.5	40.1	42.8
25–34	25.3	31.9	25.2	41.1
35–44	23.3	24.4	18.5	11.2
45–54	17.0	17.6	10.9	4.2
55–64	9.8	4.8	4.2	.7
65 and over	4.4	.8	1.1	(1)

1 Less than 0.1 of 1 percent.

It will be observed that for males there was a greater proportion in the middle age group, 25–34 years, in mail order stores than in the census data, while the reverse was true for males 55 years of age and over. Studies made of the soap industry (*5*) and the slaughter and meat packing industry (*8*) showed similar relations between the census and the report data. However, the present study showed little difference in the proportion under 25 years of age. The other studies showed the proportion in this age group to be much larger than in the census.

Among females there is a greater concentration in the age group 25–34 years than among males in this study or among either sex in the census figures. For each age group beginning with 35–44 years and continuing through 65 years and over the census data show a greater proportion of female workers.

Table 2 shows the percentage distribution of months of membership by age and sex, according to occupational group, among white employees in mail order stores. For both sexes office workers constitute the youngest group with 68.6 percent under 35 years for white males and 87.5 percent in the same age group for white females. The corresponding percentages for workers 45 years of age and over are 14.8 and 3.1, respectively. The proportion of female office workers under 25 years of age is 43 percent greater than the proportion of male office workers under that age.

Certain occupational groups among males have a membership older than the average. For example, 55.4 percent of the laborers, watchmen, and janitors, 39.6 percent of the foremen, and 37.3 percent of the repairmen and carpenters are 45 years of age and over. The first group has 18.1 percent of its membership under 35 years of age which is less than one-third the proportion of office workers who are found in this age group.

TABLE 2.—*Percentage distribution of months of membership by age and sex according to occupational group, white employees in mail order stores, 1930–34, inclusive*

Occupational group	All known ages (100 percent)	Age in years as of July 1, 1932					
		Under 25	25–34	35–44	45–54	55–64	65 and over
	White males						
All occupations	115,522	20.5	31.9	24.4	17.6	4.8	0.8
Office workers	38,154	31.8	36.8	16.6	11.5	2.6	.7
Foremen	2,756	7.4	22.9	30.1	31.6	7.4	.6
Stock handlers, truckers, wrappers, and packers	32,152	25.2	34.9	23.3	13.4	2.6	.6
Repairmen and carpenters	4,792	8.3	18.5	35.9	26.1	10.6	.6
Laborers, watchmen, and janitors	9,057	1.3	16.8	26.5	42.4	10.9	2.1
All others	28,611	9.5	29.9	32.8	19.8	7.2	.8
	White females						
All occupations	177,436	42.8	41.1	11.2	4.2	0.7	(1)
Office workers	156,843	45.4	42.1	9.4	2.6	.4	0.1
Stock handlers, wrappers, and packers	9,143	34.0	34.3	17.7	12.8	1.2	
All others	11,450	14.4	32.0	31.2	18.8	3.6	

[1] Less than 0.1 of 1 percent.

Frequency of disabilities by duration.—Table 3 shows by sex for two broad age groups the frequency of cases of disability of different durations. For nearly all durations the increase in rate with age is more marked for males than for females. For both sexes there is a greater percentage increase in rate for cases which have a relatively long duration. In other words, there is a disproportionate number of long cases among the older members of the sick benefit organization.

Another method of treating these data is by determining the percentage of cases of a given duration. Thus, it appears that cases lasting less than 29 days among males represented 71.5 percent of the total cases among the younger group and 67.3 percent among the older group, while among females the corresponding percentages were 70.2 and 61.7. Advancing age among males did not produce as great an increase in cases of longer duration as among females.

Selected indexes by age group and sex.—In considering the morbidity indexes for mail order store employees it should be remembered that white-collar workers predominate. Hence these rates as a whole should not be compared with other industries which include any considerable number of unskilled employees engaged in heavy manual labor. Comparisons are advisable only with groups of like economic and social status.

Table 4 shows that the annual number of cases per 1,000 increases with advancing age after the youngest age group for males and for each age group (except 45–54 years) among females. A similar trend with no exception among females is observed for annual number of days of disability per person and average number of days per case.

According to all three indexes the youngest age group for males has a more unfavorable rate than the next older age group.

TABLE 3.—*Frequency of sickness and nonindustrial injuries causing disability lasting 8 calendar days or longer, by sex, for the age groups under 35 years and 35 years and over, according to duration in calendar days, white employees in mail order stores, 1930–34, inclusive*

Duration of case in calendar days[1]	Age in years as of July 1, 1932			
	Males		Females	
	Under 35 years	35 years and over	Under 35 years	35 years and over
	Annual number of cases per 1,000 persons			
All durations	52.9	61.1	85.2	93.1
8–14	25.2	28.4	39.0	36.5
15–28	12.7	14.8	20.8	20.9
29–49	8.3	8.1	13.1	15.5
50–91	4.1	8.7	7.1	10.5
92–182	1.8	3.7	3.7	6.7
183–364	.8	.4	.8	*1.7*
365 and over			.7	*1.3*
	Number of cases			
All durations	267	204	1,056	222
8–14	127	130	483	87
15–28	64	68	258	50
29–49	42	37	162	37
50–91	21	40	88	25
92–182	9	17	46	16
183–364	4	2	10	4
365 and over			9	3
Number of person-years of membership	5,042.6	4,584.2	12,400.5	2,385.8

[1] Includes not-ended, maximum-benefit, and unknown-termination cases.

Italicized rates are based on less than 5 cases.

A comparison of two age groups, namely, under 25 years and 55 years of age and over shows that the ratio of the female rate to the male rate (always more than one) becomes greater at the older age for days of disability per person and average days per case, while it decreases for the annual number of cases per 1,000 persons. This would indicate that it is the length rather than the frequency of female cases which results in their more unfavorable rates when old. For example, with respect to frequency the percentage increase in rate from under 25 years of age to 55 years and over is 54 percent for males and 36 percent for females; but for days of disability per person the increase in rate is 117 percent for males and 138 percent for females, while the corresponding increase for the average days per case is 41 and 75 percent, respectively.

Frequency of disabilities by detailed diagnosis groups.—The annual number of cases per 1,000 for white males and white females of all ages is shown according to detailed diagnosis groups in table 5. While

for all diagnoses the female rate was 48 percent in excess of the corresponding male rate, yet there were specific diagnosis groups for which the male rate was in excess. The male rate was higher for nonindustrial injuries, pneumonia, ulcer of the stomach or duodenum, hernia, diseases of the circulatory system, rheumatic diseases, and other infectious and parasitic diseases. For the most part these are the same diagnoses which were found to have an excess among males in previous studies (*5*, *8*). These diagnoses in general probably reflect the more strenuous work and the more adverse environmental conditions under which males are likely to labor.

TABLE 4.—*Summary of selected morbidity indexes for different age groups, according to sex, white employees in mail order stores, 1930–34, inclusive*

Sex	All ages [1]	Age in years as of July 1, 1932					
		Under 25	25–34	35–44	45–54	55–64	65 and over
	Annual number of cases per 1,000 persons [2]						
Male	58.6	55.2	51.5	52.0	74.3	77.4	131.6
Female	80.9	78.0	92.6	93.3	90.2	101.4	*200.0*
	Annual number of days of disability per person						
Male	1.63	1.43	1.31	1.37	2.18	2.71	5.51
Female	2.49	2.12	2.56	2.92	3.07	4.88	8.40
	Average number of days per case [3]						
Male	27.8	25.9	25.4	26.4	29.4	35.0	41.9
Female	28.7	27.2	27.6	31.4	34.0	48.1	*42.0*
	Number of cases beginning during 1930–34, inclusive						
Male	575	109	158	122	126	36	10
Female	1,302	494	562	155	56	10	1
	Number of calendar days of disability						
Male	15,990	2,827	4,017	3,224	3,700	1,259	419
Female	37,308	13,449	15,517	4,860	1,906	481	42
	Number of deaths						
Male	19	1		4	8	3	3
Female	11		8	1	2		
	Number of person-years of membership						
Male	9,808.2	1,972.9	3,069.7	2,346.0	1,696.9	465.3	76.0
Female	14,983.1	6,330.3	6,070.2	1,661.7	620.5	98.6	5.0

[1] Includes a negligible number of persons of unknown age.

[2] Cases include only those which began during the study period, but days of disability include days for cases which began prior to, as well as during, the study period. This seeming excess of days of disability is compensated in part by the fact that days subsequent to 1934 are not included, even though some cases had not ended or reached 91 days at the close of the study period.

[3] Includes all days of disability during the study period, regardless of when the disability began. Disabilities which reached 91 days or over were arbitrarily terminated at 91 days.

Italicized rates are based on less than 5 cases.

TABLE 5.—*Frequency of sickness and nonindustrial injuries causing disability lasting 8 calendar days or longer, by sex, according to detailed diagnosis groups, white employees in mail order stores, 1930–34, inclusive*

Diagnosis	Annual number of cases per 1,000 persons		Number of cases	
	Males	Females	Males	Females
Total, all diagnoses	58.6	88.9	575	1,302
Nonindustrial injuries	6.8	4.0	67	60
Sickness	51.8	82.9	508	1,242
Respiratory diseases	23.4	45.5	230	682
Diseases of the pharynx and tonsils	3.0	7.6	29	114
Bronchitis, acute and chronic	2.6	3.3	26	50
Other diseases of the upper respiratory tract	6.3	14.3	62	215
Influenza, grippe	8.9	17.6	87	263
Pneumonia, all forms	.8	.7	8	10
Pleurisy	1.0	1.1	10	17
Respiratory tuberculosis	.5	.7	5	10
Other respiratory diseases	*.3*	*.2*	3	3
Digestive diseases	9.4	13.7	92	205
Diseases of the teeth and gums	.6	1.1	6	16
Ulcer of the stomach or duodenum	.7	.4	7	6
Other diseases of the stomach, cancer excepted	1.9	2.9	18	44
Diarrhea, enteritis	.6	1.1	6	17
Appendicitis, with or without appendectomy	3.3	6.8	32	101
Hernia	1.1	*.2*	11	3
Other digestive diseases	1.2	1.2	12	18
Nonrespiratory-nondigestive diseases	14.4	18.5	141	277
Diseases of the circulatory system	2.4	1.6	23	24
Genitourinary diseases	1.0	2.3	10	35
Rheumatic diseases [1]	4.6	2.8	45	42
Diseases of the nervous system [2]	.6	4.4	6	66
Diseases of the skin	.9	1.7	9	25
Other infectious and parasitic diseases	2.2	2.0	22	30
Other nonrespiratory-nondigestive diseases	2.7	3.7	26	55
Ill-defined or unknown diagnoses	4.6	5.2	45	78
Number of person-years of membership			9,808.2	14,983.1

[1] Including acute and chronic rheumatism, lumbago, neuralgia, neuritis, and sciatica.
[2] Exclusive of neuralgia, neuritis, and sciatica.
NOTES.—See footnote 2, table 4.
Italicized rates are based on less than 5 cases.

The five cause groups which showed the greatest excess for the female as compared with the male rate were, in descending order of magnitude, as follows: Diseases of the nervous system, 633 percent; diseases of the pharynx and tonsils, 153 percent; genitourinary diseases, 130 percent; appendicitis, with or without appendectomy, 106 percent; and influenza and grippe, 98 percent.

Many of the above diagnoses are not numerically of great importance when total frequency rates are considered. The broad diagnosis group which does have the most influence in producing a higher total rate for females is the respiratory group. Among females 55.7 percent of all cases with known diagnoses fell into this category while among males this percentage was 43.4. The proportion of digestive disease cases showed a difference between the sexes of less than one percent; males had a larger percentage of cases for nonindustrial injuries and nonrespiratory-nondigestive diseases, although the male frequency rate for the latter group was slightly lower than the female frequency rate.

Rates by occupation.—The frequency rate, the number of days of disability per person, and the number of days per case are shown according to occupational group in table 6. Among males the occupational group with the highest age-standardized frequency rate (83.7) was laborers, watchmen, and janitors. Following this group were repairmen and carpenters (78.8) and office workers (69.0). There were only 2 specific occupational groups among females, namely, office workers (93.2) and stock handlers, wrappers, and packers (76.9). The former was 35 percent higher than the corresponding rate for males while the latter was 26 percent higher.

TABLE 6.—*Frequency of sickness and nonindustrial injuries causing disability lasting 8 calendar days or longer, annual number of days of disability per person, and average number of days per case, according to occupational group and sex, white employees in mail order stores, 1930–34, inclusive*

Occupational group [1]	Annual number of cases per 1,000 persons		Annual number of days of disability per person	Average number of days per case	Number of cases beginning during 1930–34, inclusive	Number of calendar days of disability	Number of person-years of membership
	Standardized rate [2]	Crude rate					
	Males						
All occupations	63.4	58.6	1.63	27.8	575	15,990	9,808.2
Laborers, watchmen, and janitors	83.7	87.0	2.99	34.4	68	2,341	781.9
Repairmen and carpenters	78.8	76.1	2.04	26.8	32	857	420.5
Office workers	69.0	61.7	1.60	25.9	200	5,185	3,243.9
Foremen	66.1	64.2	2.04	31.7	15	476	233.6
Stock handlers, truckers, wrappers, and packers	61.2	54.9	1.68	30.6	149	4,554	2,713.9
All others	49.3	46.0	1.07	23.2	111	2,577	2,414.4
	Females						
All occupations	90.0	86.9	2.49	28.7	1,302	37,306	14,983.1
Office workers	93.2	89.0	2.52	28.3	1,178	33,357	13,237.8
Stock handlers, wrappers, and packers	76.9	74.8	2.23	29.8	57	1,700	761.9
All others	67.7	68.1	2.29	33.6	67	2,249	983.4

[1] See table 1.
[2] Age standardized according to the total gainfully employed workers of specified sex in the United States (*9*, p. 117).

NOTE.—See footnotes 2 and 3, table 4.

The annual number of days of disability per person among males ranged from 2.99 for laborers, watchmen, and janitors to 1.60 for office workers. Foremen, and repairmen and carpenters each had a rate of 2.04 days per person. Female office workers showed a rate of 2.52 and stock handlers, wrappers, and packers a rate of 2.23, the excess over the corresponding rates for males being 57 percent and 33 percent, respectively.

In the average number of days per case, laborers, watchmen, and janitors were again highest with 34.4, and office workers lowest with

25.9 days. The length of case among female office workers was less than 10 percent higher than among males, while among stock handlers, wrappers, and packers, females had actually a shorter average case than males.

Frequency of disabilities among office workers and all other workers.—A comparison of sickness and nonindustrial injuries in mail order stores is limited to office workers and all other workers. In table 7 this information is given for persons under 35 years of age and those 35 years and over. Frequency rates for male office workers when all diagnoses are considered show little difference with advancing age, the rate being approximately 60 in the younger and older groups. However, the rate for nonrespiratory-nondigestive disease is 56 percent greater for older males, while for digestive diseases it is 59 percent less. Female office workers show an increase in rate with age of 62 percent for nonrespiratory-nondigestive diseases, but for the other three broad diagnosis groups the increase is less, ranging from 2 to 7 percent. Among office workers, with the exception of digestive diseases, there is apparent no great sex difference in the rate of change with age.

TABLE 7.—*Frequency of sickness and nonindustrial injuries causing disability lasting 8 calendar days or longer for broad diagnosis groups by age, under 35 years and 35 years and over, for office workers and all other workers, by sex, white employees in mail order stores, 1930–34, inclusive*

Occupational group	All sickness and nonindustrial injuries [1]		Nonindustrial injuries		Sickness: Respiratory diseases		Sickness: Digestive diseases		Sickness: Nonrespiratory-nondigestive diseases	
	Under 35 years	35 years and over	Under 35 years	35 years and over	Under 35 years	35 years and over	Under 35 years	35 years and over	Under 35 years	35 years and over
	Annual number of cases per 1,000 males									
Office workers	60.1	59.1	8.3	8.0	23.8	20.0	11.7	6.0	9.6	15.0
All others	47.5	65.5	4.9	7.5	18.2	20.5	10.5	6.1	9.4	20.4
Ratio: office workers to all others	1.27	.90	1.69	1.07	1.31	.98	1.40	.98	1.02	.74
	Annual number of cases per 1,000 females									
Office workers	86.6	102.9	4.2	4.3	46.3	40.6	14.3	15.3	17.0	27.6
All others	68.6	71.6	*2.1*	*2.7*	36.4	31.8	9.4	9.3	15.6	17.2
Ratio: office workers to all others	1.26	1.44	2.00	1.59	1.27	1.56	1.52	1.65	1.09	1.60
	Ratio: female to male									
Office workers	1.44	1.74	.51	.54	1.95	1.91	.97	2.55	1.77	1.84
All others	1.44	1.09	.43	.36	2.00	1.20	.90	1.62	1.66	.84

[1] Includes a negligible number of cases of ill-defined or unknown diagnosis.

NOTES.—See footnote 2, table 4.

Italicized rates are based on less than 5 cases.

Number of person-years of membership: Males, office workers under 35 years of age 2,180.4, 35 years of age and over 999.1; all others under 35 years of age 2,862.2, 35 years of age and over 3,585.1. Females, office workers under 35 years of age 11,438.2, 35 years of age and over 1,632.0; all others under 35 years of age 932.6, 35 years of age and over 753.8.

Male workers other than office workers constitute an older group than office workers; hence a 38-percent increase in rate at age 35 years and over is not unexpected. There is a marked rise in the frequency of disabilities among older males for each diagnosis group except digestive diseases. Among female workers other than office workers age apparently has little influence; indeed, respiratory diseases show a 13 percent decrease at the older age.

In a comparison of office workers with all others it should be remembered that the former are a much more homogeneous class than the latter. Both groups, however, reflect the same general policies with regard to the recording of disabilities which were the current practice in the stores studied. Young male office workers had a greater frequency of sickness than other mail order store workers, while at an older age the reverse was found to hold. The excess in the rate among young male office workers compared with other workers was due to a greater incidence of respiratory diseases, nonindustrial injuries, and digestive diseases; the higher rate among older male nonoffice workers was due to an excess of nonrespiratory-nondigestive diseases.

Female office workers had higher frequency rates than other female workers in both age groups. The greatest excess was for nonindustrial injuries in the age group under 35 years and for digestive diseases in the age group 35 years and over.

Another comparison of interest is the ratio of the female rate to the male rate, specific for occupational and diagnosis group. Among office workers under 35 years of age females have a rate 49 percent lower than males for nonindustrial injuries, a rate almost the same for digestive diseases, and rates for respiratory diseases and nonrespiratory-nondigestive diseases which are 95 percent and 77 percent higher, respectively. Office workers 35 years of age and over have approximately the same female to male ratio as the younger group with the exception of digestive diseases which show an excess among females of 155 percent. The younger group of nonoffice workers reflects the same general pattern as office workers with respect to sex differences in rate. The ratio for all diagnoses is identical. The older group of nonoffice workers shows a tendency for a smaller female to male ratio than for office workers. This is most marked for nonrespiratory-nondigestive diseases where the female rate is lower than the male rate.

Frequency of disabilities according to marital status.—Mortality rates have been observed to vary markedly with marital status, showing for both sexes a much higher rate for single than for married persons. For example, when deaths in Canada and in New York State were placed on an age-specific basis an excess in mortality rate among the single was found for all groups, except females under 25 years of

age who had a higher rate for the married (*10, 11*). The latter may have been influenced by the hazards of child bearing among young women and the former by the operation of a selective process involving the failure to marry of persons who have serious physical defects. It has not been ascertained whether the mortality rate for single persons would remain higher were such factors made specific as physical rating, occupation, socio-economic status, and environment. An earlier study (*12*) showed, among other things, that for a group of female industrial employees the frequency rate of sickness and non-industrial injuries was greater for married than for single women, the reverse of the relationship usually found for marital status according to mortality rates. For this earlier group, the equivalent of 13,700 women under observation for one year, the frequency of disabilities lasting 7 working days or longer was 72 percent greater for ages under 25 years, and 35 percent greater for 25–44 years, among the married than among the single employees.

The present report is the first of this series in which it was practicable to present information relating to the frequency and severity of disability according to marital status. Only two groups, those married all or most of the time and those single all or most of the time, were considered. Persons who were widowed, divorced, separated, or of unknown marital status, constituting less than 4 percent of the membership, were excluded from all tables.

The frequency of disabilities is considered by specific age groups in the following table:

Marital status	Age in years as of July 1, 1932			
	Under 25	25-34	35-44	45 and over
	Annual number of cases per 1,000 white males			
Single	57.3	53.3	49.8	68.1
Married	53.1	50.3	52.0	77.4
	Annual number of cases per 1,000 white females			
Single	82.7	91.7	82.0	91.8
Married	71.2	90.1	102.8	93.5

The same trend is observed for both sexes, namely, the two age groups under 35 years show a higher rate for single than married persons, while the two age groups 35 years and over show the reverse. Furthermore, the female rate for the single as well as the married is consistently on a higher level than the corresponding male rate.

In table 8 the frequency rates for married and single persons are shown according to broad diagnosis groups. Emphasis should be placed on the age group under 35 years as the rates for ages 35 years and over are based on a membership in which there is a larger per-

centage of older persons among the married than the single. For under 35 years of age both males and females show an excess in the single rate as compared with the married rate for each broad diagnosis group with the exception of respiratory diseases among males. For all sickness and nonindustrial injuries the rate for single persons is 7 percent greater for males and 9 percent greater for females. In each of the 3 diagnosis groups classified under "sickness" the difference between the rates for married and single persons is comparatively slight among females, while among males there is greater variation. Female employees are much more homogeneous with respect to occupation than male employees in mail order stores which may be one factor influencing the more uniform rate among females.

TABLE 8.—*Frequency of sickness and nonindustrial injuries causing disability lasting 8 calendar days or longer for broad diagnosis groups by age, under 35 years and 35 years and over, for married and single employees, by sex, white employees in mail order stores, 1930–34, inclusive*

Marital status [1]	All sickness and nonindustrial injuries [2]		Nonindustrial injuries		Sickness: Respiratory diseases		Sickness: Digestive diseases		Sickness: Nonrespiratory-nondigestive diseases	
	Under 35 years	35 years and over	Under 35 years	35 years and over	Under 35 years	35 years and over	Under 35 years	35 years and over	Under 35 years	35 years and over
	Annual number of cases per 1,000 males									
Single	54.8	56.0	7.4	*3.3*	18.4	29.7	12.9	*2.2*	11.3	17.6
Married	51.1	65.3	5.8	7.8	21.8	25.3	11.5	7.2	8.0	19.7
Ratio: single to married	1.07	.86	1.28	.42	.84	1.17	1.12	.31	1.41	.89
	Annual number of cases per 1,000 females									
Single	88.2	82.5	4.7	*2.6*	46.9	43.9	14.3	10.5	17.6	19.3
Married	81.2	99.1	3.3	*2.7*	43.7	44.7	13.5	16.1	16.0	27.7
Ratio: single to married	1.09	.83	1.42	.96	1.07	.98	1.06	.65	1.10	.70
	Ratio: female to male									
Single	1.61	1.47	.64	.79	2.55	1.48	1.11	4.77	1.56	1.10
Married	1.59	1.52	.57	.85	2.00	1.77	1.17	2.24	2.00	1.41

[1] Does not include widowed, divorced, separated, or unknown cases.
[2] Includes a negligible number of cases of ill-defined or unknown diagnosis.

NOTES.—See footnote 2, table 4.
Italicized rates are based on less than 5 cases.
Number of person-years of membership: Males, single under 35 years of age 2,555.2, 35 years of age and over 910.3; married under 35 years of age 2,252.5, 35 years of age and over 3,597.4. Females, single under 35 years of age 7,255.2, 35 years of age and over 1,139.5; married under 35 years of age 4,800.2, 35 years of age and over 1,119.7.

Among persons 35 years of age and over there is an excess in the married rate (probably more apparent than real) for both sexes and all diagnosis groups except respiratory diseases among males. The

diagnosis group having the most excessive married rate is digestive diseases for both sexes.

The ratio of the female rate to the male rate among persons under 35 years of age is not greatly different by marital status. For all diagnosis groups the excess in the female rate is 61 percent for single and 59 percent for married persons. Respiratory diseases and nonrespiratory-nondigestive diseases for either marital status in the younger age group show an excess in rate for females of more than 50 percent; for digestive diseases among the married and the single the female excess is less than 18 percent, and for nonindustrial injuries the rate is favorable for females.

Additional comparisons are provided between the rates for married and single persons when the factor of duration in calendar days is added to the calculations. The following table shows by age group and sex the annual number of days of disability per person and the average number of days per case according to marital status.

Marital status and sex	Annual number of days of disability per person		Average number of days per case		Number of person-years of membership	
	Under 35 years	35 years and over	Under 35 years	35 years and over	Under 35 years	35 years and over
Single males	1.41	1.39	25.8	24.7	2,555.2	910.3
Married males	1.35	1.98	26.4	30.4	2,252.5	3,507.4
Single females	2.51	2.68	28.4	32.4	7,255.2	1,139.5
Married females	2.05	3.13	25.3	31.6	4,800.2	1,119.7

From the above table it appears that among males under 35 years there is no significant difference in number of days per person or per case. In general, for the younger age group single persons show slightly higher rates while for the older age group married persons show higher rates. There is very little difference in the average number of days per case either according to marital status or sex. Single males 35 years and over have the shortest case (24.7), on the average, and single females the longest case (32.4).

If frequency rates are calculated for office workers under 35 years of age, thus limiting in some degree the influence of occupation and age, it will be found that the already small difference between the rates for married and single females becomes even smaller, while the corresponding rates for males become slightly farther apart.

SUMMARY

This study of sickness and nonindustrial injuries causing disability lasting 8 calendar days or longer among white workers in mail order stores shows that the annual number of cases per 1,000 was 63.4 among males and 90.0 among females, while the annual number of days of disability per person was 1.63 and 2.49, respectively. The

average number of days per case was 27.8 for males and 28.7 for females.

When the frequency of disabilities among office workers was compared with all other workers in mail order stores it was found that under 35 years of age, office workers had the higher rate regardless of sex. The excess was most pronounced for nonindustrial injuries and digestive diseases.

The frequency rate among female office workers under 35 years of age, when compared with the rate for males in the same group, yielded an excess which was largely due to respiratory diseases and to a lesser extent nonrespiratory-nondigestive diseases. Digestive diseases were nearly the same for both sexes, and nonindustrial injuries were decidedly less frequent among females.

Frequency rates by marital status showed an excess for single persons in the younger age groups and an excess for married persons in the older age groups. When rates specific for age group, sex, and occupation were compared the difference between the rates for married and single persons did not appear to be significant. The commonly observed higher mortality rate for single persons is not so evident with respect to morbidity.

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(*11*) Marriage and long life. Stat. Bull., Metropolitan Life Insurance Company, 18: 7–10 (February 1937). P. 9.
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COURT DECISION ON PUBLIC HEALTH

Compensation for typhoid fever under workmen's compensation act denied.—(Idaho Supreme Court; *Hoffman et ux.* v. *Consumers Water Co. et al.*, 99 P.2d 919; decided February 23, 1940.) In a proceeding under the Idaho Workmen's Compensation Act it was sought to recover compensation for the death of an employee from typhoid fever. It appeared that the deceased had been employed in cleaning an open irrigation ditch. At the time of the contraction of the disease by the employee the ditch contained muddy pools of waste water in which were dead animals and waste matter. The physicians attending the deceased employee were of the opinion that "the source of the infection which produced the disease came from the ditch" where the deceased worked and their testimony was not contradicted. The industrial accident board denied compensation and the claimants appealed. The question presented to the supreme court was whether the typhoid fever from which the deceased died was an accidental injury incurred in the course of and arising out of his employment. The view taken by the appellate court was that compensation had to be denied as there was no proof of either an accident or an injury resulting from an accident within the meaning of the compensation law. The court said that there was "no evidence whatever the deceased was conscious of mishap, hazard, fortuitous occurrence, or misadventure from or by reason of which he sustained an injury"; nor was there "evidence of an accident resulting in an injury to the deceased which would bring the case at bar within" certain cited cases.

DEATHS DURING WEEK ENDED JUNE 15, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended June 15, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	7,956	7,602
Average for 3 prior years	7,623	
Total deaths, first 24 weeks of year	216,208	214,530
Deaths under 1 year of age	520	475
Average for 3 prior years	475	
Deaths under 1 year of age, first 24 weeks of year	12,215	12,599
Data from industrial insurance companies:		
Policies in force	65,298,017	67,194,608
Number of death claims	12,063	10,156
Death claims per 1,000 policies in force, annual rate	9.7	7.9
Death claims per 1,000 policies, first 24 weeks of year, annual rate	10.3	11.3

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JUNE 22, 1940

Summary

For the week ended June 22 the incidence of each of the nine communicable diseases included in the weekly telegraphic State reports was below the 5-year (1935–39) median. As compared with the preceding week, slight increases are recorded for diphtheria, poliomyelitis, and typhoid fever, while only measles and scarlet fever are above the figures for the corresponding week last year.

As compared with the preceding week, the number of cases of poliomyelitis increased from 42 to 51, with 15 cases in California (11 last week), 9 cases in Washington State (17 last week), 5 cases in Michigan (none last week), and 3 cases in Texas (none last week). The other cases were scattered, with only 2 States reporting as many as 2 cases.

Typhoid fever increased from 154 cases for the preceding week to 209 cases, the largest numbers being reported from Texas (28), Louisiana (23), Georgia (17), and Missouri (16).

The incidence of smallpox decreased from 78 to 40 cases, 14 of which were reported in Illinois, the same number as reported last week.

Of 24 cases of Rocky Mountain spotted fever, 15 occurred in eastern States and 9 in the northwestern States. Of 21 cases of endemic typhus fever, 7 cases were reported in Georgia, 5 in Texas, and 3 each in Alabama and Louisiana. One case of tularaemia was reported in North Carolina.

For the current week the Bureau of the Census reports 7,646 deaths in 88 large cities, as compared with 7,956 for the preceding week and with a 3-year (1937–39) average of 7,527 for the corresponding week.

Telegraphic morbidity reports from State health officers for the week ended June 22, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39	Week ended—		Median, 1935–39
	June 22, 1940	June 24, 1939		June 22, 1940	June 24, 1939		June 22, 1940	June 24, 1939		June 22, 1940	June 24, 1939	
NEW ENG.												
Maine	0	1	1	6	-------	-------	317	143	143	0	0	0
New Hampshire	0	0	0	-------	-------	-------	18	22	9	0	0	0
Vermont	0	0	0	-------	-------	-------	6	104	97	0	0	0
Massachusetts	3	1	2	-------	-------	-------	1,164	711	521	0	1	1
Rhode Island	1	2	1	-------	-------	-------	118	87	43	0	0	0
Connecticut	1	1	3	1	3	-------	13	348	107	0	0	0
MID. ATL.												
New York	9	19	30	[1]7	[1]4	[1]4	832	1,146	1,985	0	2	7
New Jersey	8	8	8	1	6	3	933	39	617	0	0	1
Pennsylvania [1]	7	15	17	-------	-------	-------	403	189	778	4	7	7
E. NO. CEN.												
Ohio	16	4	17	11	8	8	40	20	419	1	0	4
Indiana	0	4	6	2	1	3	12	9	66	3	1	1
Illinois [2]	21	16	42	2	15	13	217	22	422	1	3	4
Michigan [3]	4	8	8	8	1	1	508	256	288	0	1	2
Wisconsin	4	0	3	9	13	15	954	400	400	0	0	1
W. NO. CEN.												
Minnesota	0	2	2	-------	3	1	65	91	103	0	1	1
Iowa [2]	10	2	3	-------	5	-------	141	84	41	1	1	0
Missouri [3, 4]	1	7	12	2	-------	23	16	8	26	0	0	0
North Dakota	1	2	2	-------	17	2	4	10	10	0	0	0
South Dakota	0	0	1	-------	1	-------	3	45	2	0	1	0
Nebraska	1	1	2	-------	-------	-------	17	52	50	0	0	0
Kansas [4]	4	3	5	-------	4	4	225	54	51	0	0	0
SO. ATL.												
Delaware	0	0	0	-------	-------	-------	2	9	9	0	0	0
Maryland [2, 3]	1	1	4	2	5	1	1	79	93	0	2	2
Dist. of Col.	0	1	6	-------	1	-------	3	96	43	0	0	1
Virginia [3]	5	12	10	22	17	-------	138	217	107	3	3	8
West Virginia [3]	3	4	4	3	5	8	20	11	43	1	0	1
North Carolina	4	9	10	-------	-------	-------	84	102	102	0	0	3
South Carolina	6	5	4	110	108	52	18	8	21	0	1	1
Georgia [4]	2	8	6	2	13	-------	53	42	0	0	1	0
Florida	1	4	4	-------	4	1	82	45	7	0	0	1
E. SO. CEN.												
Kentucky	4	2	3	12	6	4	102	0	63	0	0	3
Tennessee [2, 4]	0	1	3	9	10	13	50	48	44	0	0	1
Alabama [4]	7	3	3	1	46	6	72	47	36	2	2	2
Mississippi [3]	1	0	3	-------	-------	-------	-------	-------	-------	1	1	1
W. SO. CEN.												
Arkansas	6	2	1	10	9	4	17	11	11	1	0	0
Louisiana [4]	3	10	12	19	5	9	2	23	0	1	0	1
Oklahoma	1	0	3	6	2	15	10	60	20	0	1	1
Texas [4]	20	9	22	80	51	66	379	174	158	1	0	2
MOUNTAIN												
Montana [2]	1	1	0	-------	9	2	49	72	55	0	0	0
Idaho [2, 5]	0	0	0	-------	-------	1	9	85	18	1	0	0
Wyoming [2]	0	1	0	2	-------	-------	8	40	5	0	0	0
Colorado [5]	15	10	5	1	8	-------	44	69	69	0	0	0
New Mexico	1	5	8	-------	-------	-------	62	7	13	0	0	0
Arizona	2	1	2	21	81	17	43	12	12	1	0	0
Utah [3]	3	0	0	-------	-------	-------	204	81	65	0	0	0
PACIFIC												
Washington [2]	2	0	1	-------	-------	-------	141	849	178	0	0	0
Oregon [3]	8	0	1	-------	11	8	127	85	34	0	0	0
California	15	22	22	56	20	20	174	1,038	928	0	2	4
Total	202	207	336	405	437	437	7,910	7,325	8,288	22	31	73
25 weeks	7,629	9,980	11,940	166,266	149,068	138,936	201,321	329,389	329,389	925	1,139	3,546

See footnotes at end of table

Telegraphic morbidity reports from State health officers for the week ended June 22, 1940 and comparison with corresponding week of 1939 and 5-year median—Con

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39	Week ended		Median, 1935-39
	June 22, 1940	June 24, 1939		June 22, 1940	June 24, 1939		June 22, 1940	June 24, 1939		June 22, 1940	June 24, 1939	
NEW ENG.												
Maine	0	0	0	7	4	13	0	0	0	2	0	1
New Hampshire	0	0	0	1	5	7	0	0	0	0	0	0
Vermont	0	0	0	3	2	5	0	0	0	1	0	0
Massachusetts	1	1	1	81	97	152	0	0	0	1	1	2
Rhode Island	0	0	0	0	6	11	0	0	0	3	1	0
Connecticut	0	0	0	36	25	45	0	0	0	2	1	1
MID. ATL.												
New York	0	1	1	328	217	350	0	0	0	7	10	10
New Jersey	0	0	0	161	70	70	0	0	0	0	2	3
Pennsylvania[2]	0	1	0	163	171	353	0	0	0	8	7	9
E. NO. CEN.												
Ohio	1	0	2	117	50	92	0	6	0	5	4	6
Indiana	1	1	1	23	41	41	3	10	6	2	6	4
Illinois[2]	1	2	1	317	171	247	14	5	8	4	2	9
Michigan[4]	5	2	1	118	208	283	1	2	1	3	1	2
Wisconsin	0	0	0	67	73	143	0	0	4	2	1	1
W. NO. CEN.												
Minnesota	1	1	0	20	19	58	1	8	8	0	0	0
Iowa[2]	1	0	0	21	23	55	2	3	17	2	2	2
Missouri[2 4]	1	0	0	11	25	25	0	2	2	16	6	6
North Dakota	0	0	0	12	6	20	0	0	1	0	0	1
South Dakota	0	0	0	7	4	6	1	0	7	0	0	0
Nebraska	1	1	0	11	13	13	1	5	8	1	0	0
Kansas[4]	0	0	0	16	33	33	0	1	4	3	3	3
SO. ATL.												
Delaware	0	0	0	4	1	1	0	0	0	1	0	0
Maryland[2 3]	1	0	0	19	9	30	0	0	0	1	0	4
Dist. of Col	1	0	0	6	5	7	0	0	0	1	0	0
Virginia[2]	2	2	2	5	11	12	0	0	0	3	19	10
West Virginia[3]	1	0	0	15	8	22	0	1	1	3	12	5
North Carolina	1	3	3	9	16	13	0	0	1	5	11	11
South Carolina	0	30	1	3	1	1	0	0	0	4	11	26
Georgia[4]	1	3	1	6	2	8	0	0	0	17	35	35
Florida	0	1	1	1	10	3	0	0	0	2	2	2
E. SO. CEN.												
Kentucky	2	0	1	21	9	15	0	0	0	7	11	11
Tennessee[2 4]	0	2	1	23	14	10	0	8	0	5	10	17
Alabama[4]	0	2	5	9	14	3	1	1	0	9	8	13
Mississippi[3]	0	0	0	4	4	4	1	0	0	2	3	11
W. SO. CEN.												
Arkansas	0	3	1	4	6	6	4	4	8	6	9	15
Louisiana[4]	1	0	2	5	5	5	0	0	0	23	22	21
Oklahoma	1	1	1	8	7	10	0	8	8	5	8	10
Texas[4]	3	3	1	18	15	31	5	0	2	28	24	24
MOUNTAIN												
Montana[2]	0	0	0	5	6	13	0	1	3	1	2	2
Idaho[2 4]	0	0	0	6	2	2	0	0	0	2	0	1
Wyoming[2]	0	0	0	3	2	3	0	1	1	0	0	0
Colorado[4]	0	3	0	17	20	20	3	3	1	2	6	2
New Mexico	0	0	0	0	4	9	0	1	1	1	1	2
Arizona	0	6	1	3	1	5	0	0	0	4	1	2
Utah[2]	0	0	0	2	5	18	0	0	0	0	1	1
PACIFIC												
Washington[2]	9	0	0	29	19	25	0	0	1	2	18	1
Oregon[4]	0	0	0	6	6	23	2	10	4	2	0	1
California	15	14	9	75	107	110	1	12	7	11	4	5
Total	51	83	82	1,805	1,578	2,937	40	92	144	209	255	301
25 weeks	695	713	657	111,454	109,521	155,134	1,725	8,164	7,219	2,451	3,498	3,498

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended June 2 1940, and comparison with corresponding week of 1939 and 5-year median—Con

Division and State	Whooping cough, Week ended June 22, 1940	Whooping cough, Week ended June 24, 1939
NEW ENG.		
Maine	13	73
New Hampshire	10	18
Vermont	15	25
Massachusetts	116	144
Rhode Island	5	41
Connecticut	54	54
MID. ATL.		
New York	300	362
New Jersey	94	273
Pennsylvania [2]	301	536
E. NO. CEN.		
Ohio	204	109
Indiana	21	75
Illinois [2]	93	310
Michigan [3]	207	162
Wisconsin	92	104
W. NO. CEN.		
Minnesota	34	10
Iowa [2]	44	19
Missouri [2,4]	30	28
North Dakota	13	9
South Dakota	1	1
Nebraska	19	25
Kansas [4]	56	36
SO. ATL.		
Delaware	1	9
Maryland [2,3]	148	64
Dist. of Col	4	54
Virginia [2]	52	128
West Virginia [3]	33	12
North Carolina	155	267
SO. ATL.—con.		
South Carolina	8	72
Georgia [4]	20	47
Florida	9	24
E. SO. CEN.		
Kentucky	75	44
Tennessee [2,4]	31	68
Alabama [4]	19	56
Mississippi [3]	---------	---------
W. SO. CEN.		
Arkansas	31	20
Louisiana [4]	32	37
Oklahoma	34	4
Texas [4]	350	88
MOUNTAIN		
Montana [2]	1	14
Idaho [2,5]	9	1
Wyoming [2]	7	2
Colorado [5]	21	50
New Mexico	17	33
Arizona	11	31
Utah [3]	159	46
PACIFIC		
Washington [2]	63	14
Oregon [2]	31	21
California	308	146
Total	3,420	3,862
25 weeks	80,316	98,028

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended June 22, 1940, 24 cases, as follows: Pennsylvania, 2; Illinois, 4; Iowa, 1; Missouri, 3; Maryland, 1; Virginia, 3; Tennessee, 1; Montana, 1; Idaho, 1; Wyoming, 3; Washington, 1; Oregon, 3.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended June 22, 1940, 21 cases, as follows: Missouri, 1; Kansas, 1; Georgia, 7; Tennessee, 1; Alabama, 8; Louisiana, 3; Texas, 5.
[5] Colorado tick fever, week ended June 22, 1940, 8 cases, as follows: Idaho, 1; Colorado, 7.

VENEREAL DISEASES

New Cases Reported for April 1940[1]

Reports from States

	Syphilis									Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All syphilis[2]					
	Primary and secondary	Early latent[3]	Rate per 10,000 population	Includes late-latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population
Alabama	260	228	1.67	336	1.15	33	0.11	1,594	5.44	312	1.17	9	0.03
Alaska[4]	------	------	------	------	------	------	------	------	------	------	------	------	------
Arizona	33	13	1.10	68	1.63	21	.50	213	5.10	153	3.66	2	.05
Arkansas	143	236	1.83	366	1.76	11	.05	787	3.79	73	.35	6	.03
California	[5] 352	------	.56	1,363	2.18	85	.14	1,920	3.07	1,333	2.13	29	.05
Colorado	78	------	.72	131	1.22	15	.14	224	2.08	75	.70	1	.01
Connecticut	12	18	.17	86	.49	10	.06	166	.95	84	.48	------	------
Delaware	13	12	.95	42	1.60	7	.27	172	6.54	42	1.60	------	------
Dist. of Columbia	------	------	------	------	------	------	------	707	11.12	255	4.01	4	.06
Florida	------	489	2.88	1,016	5.98	48	.28	1,720	10.12	168	.99	22	.13
Georgia	------	1,357	4.36	724	2.33	------	------	2,081	6.68	72	.23	11	.04
Hawaii	11	6	.42	29	.72	4	.10	63	1.56	71	1.76	------	------
Idaho	14	------	.28	[6] 24	.48	------	------	40	.80	21	.42	1	.02
Illinois	119	374	.62	1,255	1.59	79	.10	1,827	2.31	1,287	1.63	22	.03
Indiana	119	250	1.06	621	1.78	56	.16	1,317	3.77	128	.37	3	.01
Iowa[4]	------	------	------	------	------	------	------	------	------	------	------	------	------
Kansas	73	40	.61	89	.48	15	.08	292	1.56	116	.62	------	------
Kentucky	78	24	.31	204	.69	22	.07	509	1.72	261	.88	1	.003
Louisiana	342	------	1.60	------	------	3	.01	755	3.52	115	.54	5	.02
Maine	8	------	.09	23	.27	------	------	31	.36	39	.45	2	.02
Maryland	104	30	.80	187	1.11	24	.14	874	5.19	246	1.46	20	.12
Massachusetts	51	------	.12	389	.88	39	.09	479	1.08	368	.83	------	------
Michigan	106	132	.49	478	.98	31	.06	980	2.01	520	1.07	22	.05
Minnesota	13	23	.13	187	.70	9	.03	233	.87	137	.51	------	------
Mississippi	241	821	5.21	807	4.25	100	.49	5,018	24.60	2,480	12.16	3	.01
Missouri	176	397	1.42	269	.67	33	.08	939	2.33	198	.49	5	.01
Montana	18	------	.33	42	.77	2	.04	65	1.19	28	.51	------	------
Nebraska	18	4	.16	33	.24	4	.03	59	.43	56	.41	1	.01
Nevada	------	6	.50	13	1.27	2	.20	21	2.06	20	1.96	------	------
New Hampshire	------	1	.02	4	.08	3	.06	26	.51	11	.21	------	------
New Jersey	105	156	.60	510	1.17	35	.08	948	2.17	231	.53	------	------
New Mexico	31	2	.78	58	1.37	15	.36	106	2.51	20	.47	1	.02
New York	297	456	.58	2,891	2.22	195	.15	4,037	3.11	1,547	1.19	39	.03
North Carolina	244	840	3.07	788	2.23	82	.23	1,954	5.54	402	1.14	23	.07
North Dakota[4]	------	------	------	------	------	------	------	------	------	------	------	------	------
Ohio	208	209	.62	693	1.03	70	.10	1,180	1.75	112	.17	4	.01
Oklahoma	97	285	1.49	471	1.83	33	.13	1,087	4.23	412	1.60	11	.04
Oregon	40	83	.70	110	1.06	6	.06	192	1.85	134	1.29	------	------
Pennsylvania[4]	------	------	------	------	------	------	------	------	------	------	------	------	------
Rhode Island	3	2	.07	52	.76	3	.04	67	.98	34	.50	------	------
South Carolina	589	600	6.28	707	3.74	57	.30	1,984	10.49	62	.33	11	.06
South Dakota	15	34	.71	59	.85	8	.12	119	1.72	21	.30	------	------
Tennessee	219	403	2.13	651	2.23	65	.22	1,344	4.60	226	.77	9	.03
Texas	351	438	1.27	966	1.55	87	.14	2,352	3.77	803	1.29	40	.06
Utah	10	9	.36	73	1.40	8	.15	101	1.93	25	.48	------	------
Vermont	5	2	.18	10	.26	------	------	17	.44	7	.18	------	------
Virginia	469	347	2.97	885	3.23	89	.32	1,930	7.04	275	1.00	------	------
Washington	44	71	.69	135	.81	16	.10	283	1.69	317	1.89	------	------
West Virginia	290	134	2.23	229	1.20	71	.37	1,017	5.34	258	1.36	1	.01
Wisconsin	------	9	.03	101	.34	7	.02	117	.40	50	.17	------	------
Wyoming	10	9	.80	14	.59	2	.08	45	1.90	17	.72	------	------
Puerto Rico[4]	------	------	------	------	------	------	------	------	------	------	------	------	------
Virgin Islands[4]	------	------	------	------	------	------	------	------	------	------	------	------	------
Total	5,409	8,500	1.20	18,249	1.57	1,505	.13	41,992	3.60	13,652	1.17	308	.03

See footnotes at end of table.

Reports from cities of 200,000 population or over

	Syphilis										Gonorrhea		Other venereal diseases	
	Early			Late		Congenital		All syphilis						
	Primary and secondary	Early latent	Rate per 10,000 population	Includes late latent	Rate per 10,000 population	Number	Rate per 10,000 population	Number	Rate per 10,000 population		Number	Rate per 10,000 population	Number	Rate per 10,000 population
Akron	9	0	0.65	21	.76	2	0.07	41	1.49		10	0.69	1	0.04
Atlanta	------	195	6.49	32	1.07	------	------	227	7.56		26	.87	1	.03
Baltimore	96	13	1.30	139	1.66	6	.07	532	6.37		156	1.87	19	.23
Birmingham	92	39	4.45	143	4.86	11	.37	322	10.94		58	1.97	------	------
Boston	18	------	.23	23	.29	9	.11	155	1.95		120	1.58	------	------
Buffalo	14	5	.32	84	1.40	5	.08	108	1.80		56	.93	------	------
Chicago	80	225	.83	825	2.25	40	.11	1170	3.19		938	2.56	22	.06
Cincinnati	------	------	------	------	------	------	------	191	4.11		90	2.10	------	------
Cleveland	33	47	.85	130	1.38	14	.15	224	2.37		74	.78	11	.12
Columbus	15	23	1.21	50	1.59	12	.38	100	3.19		37	1.18	------	------
Dallas	53	50	3.50	108	3.55	2	.07	219	7.21		139	4.57	10	.33
Dayton	11	6	.77	40	1.80	------	------	57	2.57		36	1.62	1	.05
Denver	------	------	------	------				122	4.05		60	1.99		
Detroit	37	82	.06	309	2.03	15	.08	503	2.77		251	1.38	16	.09
Houston	35	84	3.32	158	4.41	11	.31	371	10.35		107	2.99		------
Indianapolis	17	2	.49	33	.86	3	.08	91	2.36		30	.78	------	------
Jersey City	7	3	.31	21	.65	2	.06	33	1.02		8	.25	------	------
Kansas City [4]	------	------	------	------	------	------	------	------					------	------
Los Angeles [4]	------	------	------	------		------	------						------	------
Louisville	18	5	.68	88	2.60	6	.18	158	4.66		57	1.68	------	------
Memphis [4]	------	------	------	------	------	------	------						------	------
Milwaukee	------	3	.05	61	.97	------	------	64	1.02		17	.27	17	.27
Minneapolis	7	7	.28	43	.86	2	.04	59	1.18		33	.66	------	------
Newark	14	12	.57	159	3.50	7	.15	192	4.23		71	1.56	------	------
New Orleans [4]	------	------	------	------	------	------	------						------	------
New York	297	360	.88	1,939	2.63	117	.16	2,928	3.91		1,231	1.64	39	.05
Oakland	------	4	.13	35	1.12	1	.03	40	1.28		17	.54	------	------
Omaha	8	2	.45	9	.40	1	.04	20	.89		11	.49	1	.04
Philadelphia [4]	------	------	------	------	------	------	------						------	------
Pittsburgh	------	------	------	------	------	------	------	427	6.06		13	.18	------	------
Portland [4]	------	------	------	------	------	------	------						------	------
Providence	1	1	.08	36	1.39	1	.04	42	1.62		19	.73	------	------
Rochester	3	------	.09	17	.50	------	------	20	.58		44	1.29	------	------
St. Louis	37	284	3.81	447	5.30	27	.32	795	9.43		181	2.15	7	.08
St. Paul	------	------	------	------	------	------	------	41	1.43		23	.80	------	------
San Antonio	27	27	2.06	131	5.01	4	.15	179	6.84		56	2.14	4	.15
San Francisco	51	------	.74	185	2.08	10	.15	246	3.57		254	3.69	10	.15
Seattle	18	15	.85	81	2.09	6	.15	125	3.23		136	3.51	1	.03
Syracuse	------	------	------	65	2.88	7	.31	72	3.19		6	.27	------	------
Toledo	3	4	.23	51	1.64	3	.10	61	1.96		20	.64	------	------
Washington	------	------	------	------	------	------	------	707	11.12		255	4.01	4	.06
Total	1,001	1,513	1.01	5,553	2.23	324	.13	10,045	3.90		4,094	1.71	164	.08

[1] Figures preliminary and subject to correction.
[2] Includes "not stated" diagnosis.
[3] Duration of infection under 4 years.
[4] No report for current month.
[5] Includes early latent of less than 1 years' duration.
[6] Includes early latent, late, and late latent.

WEEKLY REPORTS FROM CITIES

City reports for week ended June 8, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	128	46	23	4,466	424	1,452	16	380	34	1,202	--------
Current week [1]	57	62	23	3,927	285	1,258	0	375	28	1,030	--------
Maine:											
Portland	0	------	0	65	3	1	0	1	0	1	34
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	9
Nashua	0	------	0	0	0	0	0	0	0	0	10
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	0	11
Rutland	0	------	0	0	1	0	0	0	0	0	9
Massachusetts:											
Boston	0	------	1	312	10	42	0	8	0	61	198
Fall River	0	------	0	104	1	2	0	2	0	13	25
Springfield	0	------	0	4	0	9	0	0	0	11	41
Worcester	3	------	0	220	4	2	0	1	0	4	37
Rhode Island:											
Pawtucket	0	------	0	1	0	0	0	0	0	2	15
Providence	1	------	0	152	0	4	0	3	0	4	61
Connecticut:											
Bridgeport	0	------	0	2	0	1	0	1	0	2	32
Hartford	0	------	0	2	0	10	0	0	0	1	39
New Haven	0	1	0	0	0	3	0	1	1	3	45
New York:											
Buffalo	0	------	0	3	5	14	0	9	0	8	117
New York	17	9	0	484	62	323	0	85	5	75	1,696
Rochester	0	1	0	9	1	12	0	0	1	7	65
Syracuse	0	------	0	0	0	2	0	1	0	3	47
New Jersey:											
Camden	0	------	0	4	3	4	0	0	0	0	20
Newark	0	3	1	612	4	35	0	5	0	14	115
Trenton	0	------	0	0	2	9	0	3	0	5	34
Pennsylvania:											
Philadelphia	3	4	2	206	15	71	0	25	2	31	446
Pittsburgh	1	3	1	3	6	21	0	5	0	26	181
Reading	0	------	0	0	0	0	0	1	0	21	21
Scranton	0	------	------	0	------	1	0	------	0	0	------
Ohio:											
Cincinnati	2	------	0	8	1	13	0	7	0	14	128
Cleveland	0	10	0	13	6	44	0	4	1	55	178
Columbus	2	------	0	2	4	10	0	4	0	15	90
Toledo	0	------	0	4	6	22	0	4	1	12	70
Indiana:											
Anderson	0	------	0	0	0	0	0	0	1	0	8
Fort Wayne	0	------	0	2	1	3	0	0	0	5	26
Indianapolis	1	------	1	7	14	5	0	1	4	5	110
Muncie	0	------	0	0	0	0	2	0	0	3	15
South Bend	0	------	0	0	2	0	0	1	0	2	29
Terre Haute	0	------	1	0	0	1	0	1	0	5	21
Illinois:											
Alton	0	------	0	0	1	0	0	0	0	1	5
Chicago	7	6	1	120	21	372	0	51	0	39	744
Elgin	0	------	0	0	0	0	0	0	0	0	16
Moline	0	------	0	9	0	0	0	0	0	0	14
Springfield	0	------	2	0	3	1	0	0	0	2	32
Michigan:											
Detroit	1	1	2	379	8	74	0	14	3	123	267
Flint	0	------	0	4	5	6	0	0	0	4	37
Grand Rapids	0	------	1	17	4	10	0	0	0	15	31
Wisconsin:											
Kenosha	0	------	0	43	0	0	0	0	0	0	14
Madison	0	------	0	35	0	2	0	0	0	6	13
Milwaukee	0	------	0	376	3	17	0	1	0	5	68
Racine	0	------	0	5	0	0	0	0	0	1	15
Superior	0	------	0	38	0	0	0	0	0	2	9

[1] Figures for Barre estimated; report not received.

City reports for week ended June 8, 1940—Continued

State and city	Diphtheria cases	Influenza Cases	Influenza Deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
Minnesota:											
Duluth	0	------	0	2	1	0	0	0	1	0	19
Minneapolis	1	------	0	0	9	20	0	0	0	11	115
St. Paul	0	------	0	0	1	4	0	2	0	9	56
Iowa:											
Cedar Rapids	0	------	--------	18	-------	0	0	-------	0	1	--------
Des Moines	0	------	0	9	0	0	0	0	0	0	30
Sioux City	0	------	--------	0	-------	1	0	-------	0	0	--------
Waterloo	1	------	--------	4	-------	0	0	-------	0	1	--------
Missouri:											
Kansas City	1	------	0	4	0	7	0	4	0	6	94
St. Joseph	0	------	0	0	3	1	0	0	0	0	22
St. Louis	0	1	1	0	8	17	0	3	1	13	224
North Dakota:											
Fargo	0	------	1	0	2	0	0	0	0	0	18
Grand Forks	0	------	--------	0	-------	0	0	-------	0	1	--------
Minot	0	------	0	0	0	0	0	0	0	0	4
South Dakota:											
Aberdeen	0	------	--------	0	-------	0	0	-------	0	1	--------
Sioux Falls	0	------	0	0	0	2	0	0	0	0	8
Nebraska:											
Lincoln	0	------	--------	1	-------	3	0	-------	0	2	--------
Omaha	0	------	0	13	2	4	0	0	1	2	57
Kansas:											
Lawrence	0	------	0	1	1	0	0	0	0	3	7
Topeka	0	1	0	22	0	2	0	0	0	3	19
Wichita	0	------	0	1	3	1	0	1	0	5	26
Delaware:											
Wilmington	0	------	0	0	2	2	0	0	0	2	26
Maryland:											
Baltimore	1	2	2	1	5	9	0	19	0	95	231
Cumberland	0	------	0	0	0	0	0	0	0	0	10
Frederick	0	------	0	0	0	0	0	0	0	0	3
Dist. of Columbia:											
Washington	3	2	1	2	9	21	0	8	0	5	149
Virginia:											
Lynchburg	0	------	0	0	0	1	0	0	1	12	7
Norfolk	0	5	0	15	0	6	0	0	0	2	28
Richmond	0	------	0	2	2	1	0	5	0	3	62
Roanoke	0	------	0	60	0	0	0	0	0	1	20
West Virginia:											
Charleston	0	------	0	0	2	0	0	0	0	0	21
Huntington	0	------	--------	0	-------	1	0	-------	0	0	--------
Wheeling	0	------	0	0	1	0	0	0	0	1	23
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	-------	0	1	--------
Raleigh	0	------	0	0	0	0	0	0	0	0	8
Wilmington	0	------	0	0	0	0	0	0	0	0	13
Winston-Salem	0	------	0	0	0	0	0	0	0	0	8
South Carolina:											
Charleston	0	6	0	1	0	1	0	1	0	0	18
Florence	0	------	0	0	1	0	0	1	0	0	19
Greenville	0	------	0	1	4	0	0	0	0	4	13
Georgia:											
Atlanta	0	1	2	12	2	2	0	7	0	1	75
Brunswick	0	------	0	0	0	0	0	0	0	0	6
Savannah	0	3	1	0	1	0	0	0	1	1	37
Florida:											
Miami	1	------	0	0	2	2	0	0	1	0	22
Tampa	0	------	0	39	2	0	0	0	0	2	27
Kentucky:											
Ashland	0	------	0	0	0	0	0	0	0	0	4
Covington	0	------	0	14	0	0	0	1	0	0	12
Lexington	0	------	0	39	1	2	0	0	0	7	16
Louisville	0	------	0	17	1	11	0	2	0	42	60
Tennessee:											
Knoxville	0	------	1	7	1	3	0	4	0	0	20
Memphis	0	------	0	35	1	11	0	4	0	9	79
Nashville	0	------	0	8	2	3	0	3	0	10	44
Alabama:											
Birmingham	0	3	1	5	1	2	0	3	1	0	56
Mobile	0	------	1	0	1	0	0	1	0	0	23
Montgomery	1	------	--------	0	-------	1	0	-------	0	5	--------
Arkansas:											
Fort Smith	0	------	--------	0	-------	0	0	-------	0	1	--------
Little Rock	0	------	0	2	0	0	0	1	0	2	--------

City reports for week ended June 8, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Louisiana:											
New Orleans	0	------	0	0	5	0	0	13	0	0	121
Shreveport	0	------	0	0	4	0	0	1	1	0	27
Oklahoma:											
Oklahoma City	0	------	0	0	1	3	0	0	1	4	40
Tulsa	0	------	0	1	1	1	0	1	0	6	24
Texas:											
Dallas	0	------	0	107	3	0	0	5	0	10	70
Fort Worth	0	------	0	1	1	0	0	1	0	12	39
Galveston	0	------	0	0	3	1	0	0	0	0	19
Houston	2	------	0	4	4	0	0	10	1	10	114
San Antonio	1	------	0	2	3	0	0	5	1	8	81
Montana:											
Billings	0	------	0	0	0	0	0	0	0	0	10
Great Falls	0	------	0	39	0	0	0	1	0	0	10
Helena	0	------	0	1	0	0	0	0	0	0	3
Missoula	0	------	0	0	0	0	0	0	0	0	6
Idaho:											
Boise	0	------	0	2	0	0	0	0	0	0	7
Colorado:											
Colorado Springs	0	------	0	0	0	1	0	0	0	0	9
Denver	4	------	0	19	2	1	0	6	0	0	70
Pueblo	0	------	0	5	0	1	0	0	0	0	14
New Mexico:											
Albuquerque	1	------	0	1	0	2	0	0	0	6	12
Utah:											
Salt Lake City	0	------	0	216	0	0	0	2	0	88	38
Washington:											
Seattle	0	------	0	94	0	3	0	2	2	28	81
Spokane	0	1	1	1	3	0	0	3	0	2	28
Tacoma	1	------	0	7	1	3	0	0	0	0	23
Oregon:											
Portland	1	------	0	25	2	1	0	1	0	15	78
Salem	0	------	--------	1	------	0	0	------	0	0	--------
California:											
Los Angeles	1	4	0	20	4	12	0	18	0	51	326
Sacramento	4	------	0	0	3	2	0	3	0	34	43
San Francisco	0	------	0	4	3	5	0	9	0	24	167

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Massachusetts:			
Boston	1	0	0
New York:			
Buffalo	1	0	0
New York	2	0	0
Syracuse	1	0	0
Pennsylvania:			
Pittsburgh	1	1	0
Ohio:			
Cleveland	1	0	0
Michigan:			
Detroit	1	0	0
Maryland:			
Baltimore	1	1	0
Alabama:			
Birmingham	0	1	0
Washington:			
Tacoma	0	0	5
California:			
Los Angeles	0	0	7

NOTE.—Information has been received that instead of 10 cases of meningococcus meningitis, 10 cases of whooping cough should have been shown in the Public Health Reports of Feb. 23, p. 340, as having occurred in Seattle, Wash., during the week ended Feb. 3, 1940.

Encephalitis, epidemic or lethargic.—Cases: New York, 1; Rochester, 2; Pittsburgh, 1.

Pellagra.—Cases: Raleigh, 1; Savannah, 1; Birmingham, 1; Los Angeles, 1.

Typhus fever.—Cases: New York, 1; Raleigh, 1; Savannah, 1.

FOREIGN REPORTS

SWEDEN

Notifiable diseases—April 1940.—During the month of April 1940, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	6	Scarlet fever	3,120
Diphtheria	10	Syphilis	25
Dysentery	14	Typhoid fever	2
Gonorrhea	720	Undulant fever	12
Paratyphoid fever	3	Weil's disease	2
Poliomyelitis	14		

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place		January-March 1940	April 1940	May 1940—week ended—			
				4	11	18	25
ASIA							
India	C	8,568					
Bassein	C		12	54	30	82	14
Calcutta	C	540	268	62	87	64	94
Cawnpore	C		10				1
Chittagong	C			1		2	1
Madras	C	1					
Porto Novo	C	1					
Rangoon	C	30	1	1	2	1	1
India (French)	C	16					
Indochina (French)	C	436					
Thailand	C	232	3				

PLAGUE

Place		January-March 1940	April 1940	May 1940—week ended 4	11	18	25
AFRICA							
Belgian Congo	C	3		4			1
British East Africa:							
Kenya	C	6					
Uganda	C	53					
Egypt	C	240	115	14	22	9	[1] 6
Madagascar	C	413					
Morocco.[2]							
Rhodesia, Northern	C	1					
Senegal:							
Dakar	D	[3] 1					
Thies	C			1			
Union of South Africa	C	6	6				

[1] Includes 5 cases of pneumonic plague.
[2] A report dated May 11, 1940, stated that there was an epidemic of bubonic plague in southern Morocco, where several hundred cases had been unofficially reported.
[3] Imported.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE—Continued

[C indicates cases; D, deaths]

Place		January-March 1940	April 1940	May 1940—week ended— 4	11	18	25
ASIA							
Dutch East Indies: Java and Madura	C	121					
India	C	8,115					
Bassein	C	9	7	1			
Cochin	C	1					
Plague-infected rats		3					
Rangoon	C	4[4]					
Indochina (French)	C	3					
Thailand:							
Bangkok	C	3					
Bisnulok Province	C	3					
Dhonpuri Province	C	1					
Jayanad Province	C	3					
Kamphaeng Bajr Province	C	29					
Kanchanapuri Province	C	12					
Koan Kaen Province	C	5					
Nagara Svarga Province	C	30					
Noangkhay Province	C	4					
Sukhodaya Province	C	22					
EUROPE							
Portugal: Azores Islands	C	2					
NORTH AMERICA							
United States. (See issues of June 14, p. 1094, and June 21, p. 1138.)							
SOUTH AMERICA							
Argentina:							
Salta Province	C	2					
Santiago del Estero Province	C		6				
Tucuman Province	C		3				
Peru:							
Cajamarca Department	C	9					
Lambayeque Department	C	8					
Libertad Department	C	42					
Lima Department	C	24					
Piura Department	C	6					
OCEANIA							
Hawaii Territory: Plague-infected rats		10	2		1		

[4] Includes 1 imported case.

SMALLPOX

Place		January-March 1940	April 1940	May 1940—week ended— 4	11	18	25
AFRICA							
Algeria	C	1					
Angola	C	20					
Belgian Congo	C	1,004	352	59	6	3	8
British East Africa	C	9					
Dahomey	C	17					
French Guinea	C		13				
Gibraltar	C	1[1]					
Ivory Coast	C	97	13				
Nigeria	C	959					
Niger Territory	C	302	57		41		
Nyasaland	C	7					
Rhodesia, Southern	C	109	20				
Senegal	C	67	36	28			
Sierra Leone	C	7					
Sudan (Anglo-Egyptian)	C	204	84	30	21	30	14
Sudan (French)	C				1		
Union of South Africa	C	46					
ASIA							
Arabia	C	255					
China	C	372	140	26	44	8	32
Chosen	C	533					

[1] Imported.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX—Continued

[C indicates cases; D, deaths]

Place		January-March 1940	April 1940	May 1940—week ended— 4	11	18	25
ASIA—continued							
Dutch East Indies—Sabang	C	4					
India	C	49,311					
India (French)	C	5					
India (Portuguese)	C	4					
Indochina (French)	C	710					
Iran	C	142					
Iraq	C	82	31	12		5	5
Japan	C	262		[1] 196			
Straits Settlements	C	1					
Sumatra	C	1					
Thailand	C		5	1			2
EUROPE							
Great Britain	C	2					
Greece	C	16					
Portugal	C	46	3	3	3		
Spain	C	209	29				
Turkey	C	139					
NORTH AMERICA							
Guatemala	C	1					
Mexico	C	43		4			
SOUTH AMERICA							
Bolivia	C	24					
Brazil	C	1					
Colombia	C	539					
Ecuador	C			1			
Venezuela (alastrim)	C	85	16				

[1] For the period Mar. 27 to May 3, 1940.

TYPHUS FEVER

Place		January-March 1940	April 1940	May 1940—week ended— 4	11	18	25
AFRICA							
Algeria	C	567	385		159		118
Belgian Congo	C	1,194	16				
British East Africa	C	1					
Egypt	C	1,708	813		158	139	96
Eritrea	C	40					
Morocco	C	152	64	31	9	12	6
Tunisia	C		247	268			
Union of South Africa	C	74					
ASIA							
China	C	284	462				
Chosen	C	5					
India	C	2	1				
Iran	C	196					
Iraq	C	29	43		2	2	10
Japan	C	1	1				
Palestine	C	20	14	1	3		5
Trans-Jordan	C	13				2	
EUROPE							
Bulgaria	C	48	9	5	16	2	5
Germany	C	24	47				
Greece	C	6	8	3	1	5	1
Hungary	C	36	16	1	1	2	13
Lithuania	C	31					
Rumania	C	868	109	61		32	22
Spain	C	3		3			
Turkey	C	421					
Yugoslavia	C	155	66				
NORTH AMERICA							
Guatemala	C	127	2				
Mexico	C	199	38	1			1
Panama Canal Zone	C	3					

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER—Continued

[C indicates cases; D, deaths]

Place		January–March 1940	April 1940	May 1940—week ended— 4	11	18	25
SOUTH AMERICA							
Bolivia	C	165					
Chile	C	30					
Ecuador	C	1	1				
Venezuela	C	4					
OCEANIA							
Australia	C	8	1	1			
Hawaii Territory	C	7	5			1	

YELLOW FEVER

Place		January–March 1940	April 1940	May 1940—week ended— 4	11	18	25
AFRICA							
Cameroon: Nkongsamba	C	[1] 1					
French Equatorial Africa: Fort Archambault	C	[1] 1					
Gold Coast	C		1				
Ivory Coast	C	1					
Nigeria: Oshogbo	C			[1] 1			
SOUTH AMERICA							
Brazil:							
Espirito Santo State	D	[2] 28					
Rio de Janeiro State	D	[2] 1					
Colombia:							
Antioquia Department—San Luis	D	2					
Caldas Department—							
La Pradera	D	1					
Samana	D	1					
Victoria	D	1					

[1] Suspected.
[2] Jungle type.

X

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